Birds in Wales
Adar yng Nghymru

2021 WOS CAC 18:1

Birds in Wales

Adar yng Nghymru

18:1 August 2021 ISSN 2045-6263

Edited by Anthony Caravaggi and Ian M Spence

Welsh translations by Rhion Pritchard

CONTENTS

Editorial 2

Crimes against raptors in Wales 1990-2019 3

Features of the nests of Buzzards *Buteo buteo* in north-east Wales, 1978-2011 20

The population status of the Willow Tit in Ceredigion 31

Llysdinam's contribution to ornithology in Mid-Wales 36

Avocet *Recurvirostra avosetta* responses to predator activity at Newport Wetland Nature Reserve . 44

Eagles in Wales: a review of ornithological literature, county avifaunas 1889-2000 and Welsh place names 53

Blackcaps wintering in Wales, 1999/2000 – 2020/21 65

Preliminary observations of the impact of non-native pheasants, *Phasianus colchicus,* on the abundance and diversity of invertebrates in upland pasture in mid-Wales. 80

A Pied Flycatcher – one of many 88

Montagu's Harrier's in Pembrokeshire and an historic photograph 93

A tribute to Graham Rees 96

A gallery from the first WOS photo competition 100

Published in August 2021 by The Welsh Ornithological Society
https://birdsin.wales/
Charity no. 1037823
Price: £12.00

Editorial

Welcome to the latest issue of Birds in Wales. It is a great honour to introduce myself as the new Editor of Birds in Wales. The role is a substantial responsibility and I thank the Welsh Ornithological Society Council for entrusting me with this position, going forward. I am grateful for their faith in my abilities. I am honoured to follow in the footsteps of Rhion Pritchard who guided the journal so successfully for many years. I am extremely excited about the future of the journal and I hope that I can help spread knowledge and awareness of Welsh avifauna and help the journal and, indeed, WOS, go from strength to strength.

My name may not be familiar to many, if any, of you. I grew up in the Rhondda valley but have spent much of the last 20 years moving around as I pursued my studies and, eventually, career. I am now a Lecturer in Conservation Biology at the University of South Wales and I live, once more, in the upper Rhondda. Academically, I study the ecology of many species, including Hen Harriers, Pied Avocets, Sedge Warblers, Pied Flycatchers, Hawfinch and Blue and Great Tits. Personally, I have been a birder since my teens and regularly contribute to national surveys as well as monitoring a local patch.

There are some wonderful papers in this, my first issue as Editor. They range from a detailed and much-needed exploration of crimes against raptors in Wales, to a piece commemorating the contribution of Llysdinam to ornithology in Wales, to a wonderful article describing a single breeding Pied Flycatcher across nine years at the same site. I am grateful to all those who reviewed articles for this issue. Thanks also to Giles Pepler for providing the piece on WOS's first photography competition and to Ian Spence for his help with the editing and layout for this issue.

All at WOS were saddened to learn of the recent passing of one of the Society's founding members, Graham Rees. Graham made a substantial contribution to Welsh ornithology. This issue contains an obituary by Bob Haycock.

Finally, the journal will be changing a little in the near future. More information will be made available as soon as possible. In the meantime, we are always keen to hear from people who would like to contribute articles to the journal. If you have any ideas, please do get in touch to discuss them.

Best wishes,

Anthony Caravaggi

Crimes against raptors in Wales 1990-2019

Julian Hughes[1]*, Helen Mason[2], Matthew Bruce[2] and Guy Shorrock[2]
**Corresponding author: julian.hughes@rspb.org.uk*
[1] RSPB Cymru, Llys Castan, Parc Menai, Bangor, LL57 4LF.
[2] RSPB, The Lodge, Sandy, Bedfordshire SG19 2DL.

Crynodeb
Cyrhaeddodd poblogaeth nythu nifer o rywogaethau o adar rheibus eu hisafbwynt yng Nghymru rhwng 1850 a 1950 oherwydd effaith pobl mewn tri modd uniongyrchol (i) erlid (megis saethu, trapio a difa nythod), (ii) dwyn wyau a (iii) dwyn cywion o nythod. Arweiniodd hyn at ddiflaniad dros dro rhai rhywogaethau ac effaith negyddol arwyddocaol ar ddosbarthiad a phoblogaeth eraill. Mae niferoedd y rhan fwyaf o rywogaethau yn awr yn cynyddu. Yn y papur yma, ceir crynodeb o ddigwyddiadau o'r math yma wedi eu cadarnhau a gasglwyd gan RSPB dros dri degawd (1990-99, 2000-09 a 2010-19). Mae dwyn wyau a chywion bron wedi dod i ben er 2010 a'r nifer o achosion o erlid wedi bod yn is er 2000 nag oedd yn y 1990au. Fodd bynnag, nid yw'r gostyngiad wedi parhau, ac mae'r nifer o achosion o gamddefnydd plaladdwyr/gwenwyn yn uwch yn y degawd diwethaf nag yn ystod y ddau flaenorol. Nid yw'r gostyngiad mewn erlid yn gyson ar draws pob rhan o Gymru. Cawsom fod perthynas gref rhwng y nifer o achosion o erlid adar rheibus mewn sgwariau 10-km a phresenoldeb tir a reolir ar gyfer saethu gyredig Ffesant *Phasanius colchicus*, Petrisen Goesgoch *Alectoris rufa* a Grugiar Goch *Lagopus lagopus*. Trafodir effaith erlid ar faint poblogaeth ac ar ddosbarthiad adar rheibus yng Nghymru.

Abstract
The breeding populations of many raptor species in Wales reached low points between 1850 and 1950 as a result of three direct forms of human impact: (i) persecution (such as shooting, trapping and nest destruction), (ii) the theft of eggs and (iii) the removal of chicks from nests. These activities led to the temporary eradication of some species and significant negative impacts on distribution and populations of others. Most species are now in recovery. This paper summarises confirmed incidents of these activities collected by the RSPB over three decades (1990-99, 2000-09 and 2010-19). The number of egg- and chick-thefts recorded has almost ceased since 2010 and the number of persecution incidents has been lower since 2000 than in the 1990s. However, the decreasing trend has not continued and the number of incidents involving the abuse of pesticides/poisons was highest in the most recent decade of the three reviewed. The rate of reduction in persecution is not uniform across all parts of Wales. We found a strong association between the occurrence of raptor persecution events in 10-km squares and the presence of land managed for driven shooting of Pheasant *Phasanius colchicus*, Red-legged Partridge *Alectoris rufa* and Red Grouse *Lagopus lagopus*. The role of persecution on population size and distribution of raptors in Wales is discussed.

Introduction
Populations of raptors in Britain were greatly reduced during the 19th century and recovered slowly during the 20th century. Goshawk *Accipiter gentilis,* Honey-buzzard *Pernis apivorus*, Marsh Harrier *Circus aeruginosus* and Montagu's Harrier *Circus pygargus* were extirpated from Wales prior to 1900 and Hen Harrier *Circus cyaneus* ceased to breed regularly during 1910-58. These populations recovered subsequently, although the return of Goshawk was reliant on introductions from captive stock (Kenward 2006) and the return of Montagu's Harriers proved to be localised and short-lived (Pritchard *et al.* 2021).

The major driver of these losses was human interference, designed to increase productivity from livestock and game-management, to obtain birds for falconry and to satisfy demand for the collection of eggs and skins. The scale of destruction in some parts of Wales is evident from records kept by gamekeepers, such as those on Penrhyn Estate, between Penmachno and Dolwyddelan in Caernarfonshire, who killed 1,988 Kestrels *Falco tinnunculus*, 735 Sparrowhawks *Accipiter nisus*, 228 Merlins *Falco columbariu*s and 135 Buzzards *Buteo buteo* during 1874-1902 (Lovegrove 2007). In addition, rare birds – including several raptor species – were targeted for taxidermy and by egg-collectors, and birds of several species were removed from the wild for falconry purposes. For example, 21 of the 89 known Red Kite *Milvus milvus* nesting attempts in Wales during 1900-47 were robbed (24%), and the annual rate of loss remained high (12%) during 1948-59. This contributed to the species' near-extinction from Wales, and the slow rate of its recovery (Lovegrove *et al.* 1990).

Legislation to protect birds was introduced progressively from the late 19th century. The Wild Birds Protection Act 1896 gave powers to County Councils to protect birds, their eggs and specific habitats but local government resources were rarely available to enforce this protection even where Orders were introduced. The Protection of Animals Act 1911 was the first legislation aimed at protecting birds of prey, making it illegal to use poisons and poisoned baits in situations that put wild birds at risk of harm. The Protection of Birds Act 1954 made it illegal, for the first time, to kill or injure (most) wild birds, their nests and eggs, although protection for Sparrowhawk was only added in 1962.

The Wildlife and Countryside Act 1981 remains the backbone of wild bird legislation in Britain, initially implementing the European Union 'Birds Directive'. It secured more complete protection for all wild birds across Britain, introduced special protection measures for a select group of species, including 12 breeding raptor species and Barn Owl *Tyto alba*. It also required Special Protection Areas to be designated and managed for some species, including Short-eared Owl *Asio flammeus* and seven diurnal raptor species that breed regularly in Wales.

In the last 40 years, additional legislation has increased the penalties available to the judiciary, including custodial prison sentences. Increased penalties and improved enforcement, as well as changing social attitudes, led to an unmeasured reduction in the collecting of eggs and birds being killed for taxidermy. However, illegal persecution continues to be the most severe constraint on the populations of some raptors in Britain, notably Golden Eagle *Aquila chrysaetos* (Whitfield *et al*. 2008) and Hen Harrier (Murgatroyd *et al*. 2019).

Earlier reviews recorded approximately 48 raptors shot and four trapped in Wales during 1971-87 (Cadbury *et al*. 1988) and 70 poisoning incidents (Cadbury 1992) during 1979-90, although it is unclear whether consistent criteria were used to confirm incidents. Public awareness of illegal killing and the investigation of incidents by police and government agriculture departments were almost certainly lower during that period than subsequently, improvements to both having occurred as a result of campaigning and advocacy by the RSPB and others. Tackling raptor persecution is one of UK Government's seven wildlife crime priorities. The Raptor Persecution Priority Delivery Group (RPPDG) was established in 2009 and includes a range of statutory and non-statutory agencies (**nwcu.police.uk/how-do-we-prioritise**).

The purpose of this analysis is to assess how the number of detected incidents of persecution, egg- and chick-theft has changed across Wales, spatially and temporally, over the last three decades.

Method

Collation of data

Data were collated from the most complete central dataset on offences against wild bird legislation in the UK, held by the RSPB, which focuses primarily on species of conservation concern. Information about potential crimes against birds comes from numerous sources, including members of the public, police forces, National Wildlife Crime Unit (NWCU), Welsh Government, Chemicals Regulations Directorate (CRD), Raptor Study Group fieldworkers, the RSPCA, The Zoological Society of London, Predatory Bird Monitoring Scheme, Food and Environment Research Agency (FERA) Science Ltd, and veterinary practices, in addition to incidents detected by RSPB field staff.

Information is recorded consistently and rigorously by the RSPB Investigations Team, a specialist unit that assists statutory agencies with the investigation and prosecution of crimes against wild birds. The team includes specialist officers with investigative (field-based) and intelligence (office-based) capability. The RSPB has been recording wildlife crime consistently for several decades, the results of which are published in an annual Birdcrime report (e.g. RSPB 2020). Confirmed raptor persecution incidents are also available via the RSPB's Raptor Persecution Map Hub (**rspb.org.uk/raptormap**).

We categorised the data under three broad headings: persecution, egg-theft (collecting), and egg- or chick theft (falconry). Annual records for incidents in Wales do not provide a clear trend, so we have treated the data in ten-year time series.

The data, commonly referred to as 'incidents of bird crime', are categorised by the RSPB based on certainty:

Confirmed: incidents typically substantiated by evidence such as post-mortem or toxicological analysis, or reliable eyewitness evidence. High confidence that the incident occurred (95% certainty and above).

Probable: circumstances indicate that the most likely explanation is that an illegal act has taken place. Medium confidence (50%-95%) that the incident occurred.

Unconfirmed: circumstances indicate that an illegal act has possibly taken place. Lower confidence (<50%) that the incident occurred.

For this review, only confirmed incidents were used due to their high evidential weighting; 'probable' or 'unconfirmed' incidents were excluded. For each incident, we collated details of the incident type, date, Ordnance Survey 10-km square, local authority and police force area, the numbers and species of bird involved and, for incidents of poisoning or the possession of poison, the type involved and/or the bait onto which it had been placed. The data extracted did not include any personal information or information relating to any subsequent investigation.

Incident categories are assigned by RSPB Investigations staff, who assess all the evidence and intelligence around an incident and record the data according to the strongest evidence. Most incidents of shooting or trapping of a bird, for example, involve a single dead or injured raptor, but circumstances will determine how other incident types are recorded. There can, for example, be multiple offences and victims of more than one species within one incident.

Persecution

Raptor persecution involves incidents relating to the illegal killing of raptors, the use or possession of traps, poisons and other items to target raptors, and attempts to commit such offences. This includes circumstances where raptors may not have been the intended target but were vulnerable to the offence committed (e.g. laying out a poisoned Rabbit *Oryctolagus cuniculus* bait for a Fox

Vulpes vulpes). The motivation for killing, or attempting to kill, raptors is normally associated with: desire to prevent or reduce predation of other animals valued by a sector of society. The primary conflict in the UK relates to land managed for gamebird shooting, but protection of livestock and domestic (racing) pigeons *Columba livia* is also relevant.

For simplicity, in this paper we refer to 'poisoning' as the abuse of pesticides or other substances, such as veterinary products. It does not include incidents of secondary poisoning typically associated with the use of rodenticides. Toxicology results from Welsh Government's Wildlife Incident Investigation Scheme (WIIS) form the primary source of wildlife poisoning data. Exceptionally, toxicology results may be obtained *via* private analysis where victims or baits have not been accepted for analysis by the government scheme.

Poisoning incidents are counted as separate where a bait/victim or group of baits/victims are found on a different date; found sufficiently far apart to be represented by a different six-figure grid reference; or found at the same grid reference and on the same date but in circumstances that otherwise separate them (for example, if a very decomposed victim is found beside a fresh bait, the bait could not have been responsible for its death).

A bait confirmed to contain a poisonous substance may have affected no birds, a single bird or multiple individuals (and/or scavenging species of mammal or even a pet dog). Equally, a dead raptor confirmed to contain poison may represent the minimum affected by a bait, with other victims not discovered. The poisoning incidents classed as confirmed are where toxicology results, along with other information and intelligence, meet the evidential weighting of 95% confidence that raptors were victims, targeted or vulnerable.

Temporal changes in the number and type of persecution incidents, as well as the species affected, were examined by calculating these separately for each of the three decades (1990-99, 2000-09, 2010-19). Spatial patterns of persecution were assessed by calculating the number of persecution incidents in each decade for each (i) vice-county and (ii) British National Grid 10-km square. Finally, we examined whether there was any evidence of an association between the spatial distribution of persecution incidents and gamebird shooting. This was done using logistic regression to model the presence/absence of persecution events in 10-km grid squares as a function of whether there was also land managed for gamebird shooting in those squares. Information on the presence of shoots within 10-km squares was derived from the **gunsonpegs.com** website (retrieved January 2021), with shoots filtered to only include those where the quarry was Pheasant, Red-legged Partridge and Red Grouse driven towards guns. As only recent information was available for the spatial distribution of gamebird shoots, we restricted the analysis of persecution events to those in the most recent decade, 2010-19. Current shoot locations are not necessarily expected to be representative of those in the earlier decades considered by this study.

Egg-theft (collecting)

Unlike reports of persecution, egg-collecting data are frequently sourced from field studies and/or the subsequent discovery of eggs in a collection accompanied by data detailing dates and locations of the theft. Thus, it can be many years before thefts of clutches come to light; and some never will. Eggs taken for collections are normally at early stages of incubation when the eggshells are in better condition and the living contents are easier to remove ('blow'). These are distinguished from egg-thefts for falconry in the analysis.

Egg- and chick-theft (falconry)
Nests robbed for falconry (most commonly Peregrine *Falco peregrinus*, Goshawk and Sparrowhawk) generally involve the theft of eggs at an advanced stage of incubation, which are more likely to be viable for hatching. It can also involve the removal of young chicks of a suitable size to be fitted with closed leg rings. Field data on nest site failure will often allow an assessment of the motive for targeting the nest site.

Results

Persecution
During 1990-2019, 274 confirmed incidents were detected in Wales where a bird of prey was killed or was the target of persecution. The annual total has varied greatly, from just one in 2015 to 25 each in 1995 and 1996. The number of raptor persecution incidents was highest in the 1990s (n=133), which accounted for 49% of the total over the last 30 years. However, there was little difference in the number of confirmed incidents in 2000-09 (n=69) compared to 2010-19 (n=72; fig.1).

The nature of offences has changed substantially over this period (fig.2). Most notably, the proportion of incidents involving poisons has more than doubled, from 34% of the total in 1990-99 to 72% in 2010-19. Despite the overall reduction in raptor persecution incidents detected between those periods, the number of poisoning incidents was higher in 2010-19 (n=52) than in each of the previous two decades (n=43, 39).

The proportion of incidents that involved shooting fell slightly between 1990-99 and 2010-19 and the other types of incident reduced more substantially. In the most recent decade, there were only single incidents involving illegal pole/spring trapping, the illegal use of another trap, nest destruction, and of a person found to be in possession of items capable of being used to commit an offence.

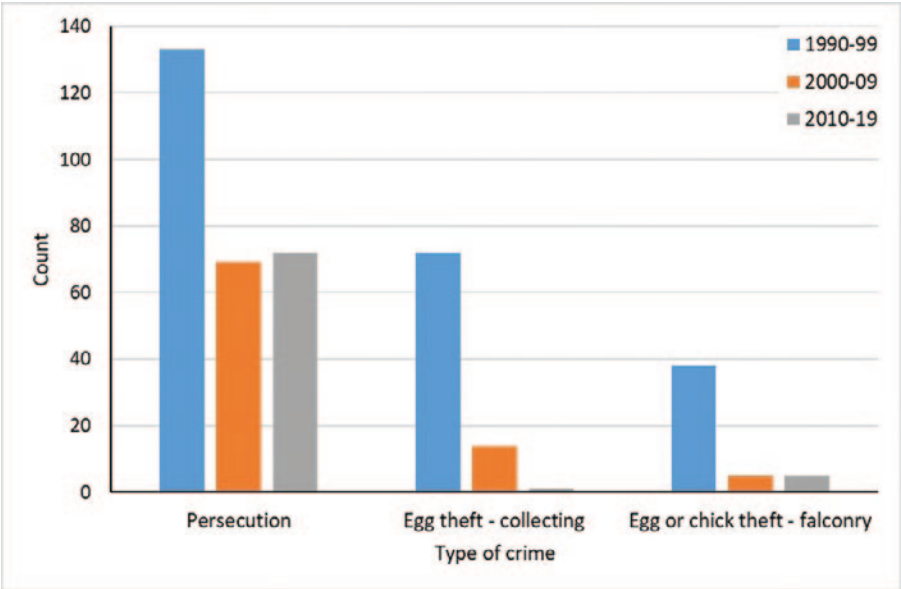


Figure 1. Confirmed incidents of raptor crime in Wales, 1990-2019.

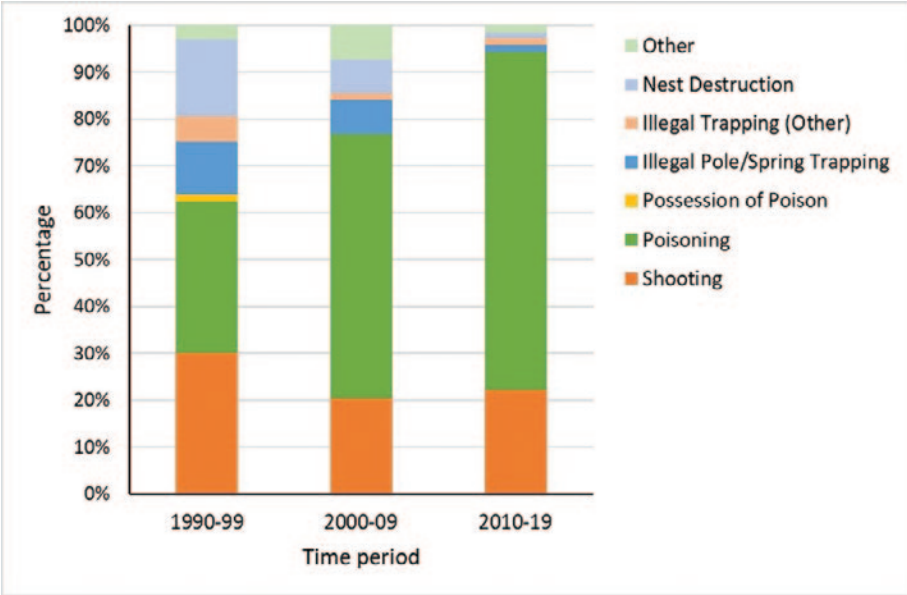


Figure 2. Proportion of confirmed incidents of raptor persecution in Wales assigned by incident type, 1990-2019.

In those incidents (n=184) where it was possible to identify a bird of prey victim of persecution, there was a total of 232 victims. Of these, Peregrine (n=79), Buzzard (n=71) and Red Kite (n=52) accounted for 87% of the total (fig.3). There were an additional 90 incidents where raptors were targeted but no dead birds were found, or where the precise number could not be determined (e.g. destruction of a nest where the number of eggs/chicks destroyed was not known, or where a pole trap was set and no victim was found). The reduction in the number of victims over time was greatest for Peregrine, whereas the number of Buzzards was similar in each decade and the numbers of Red Kites fluctuated. The number of incidents assigned to unknown species reduced to a lesser degree, consistent with the relative increase in the number of poisoning incidents, in which victims are frequently not found.

There were 22 types of pesticide or poison used to kill or target raptors in Wales during 1990-2019. In combination, there were 145 instances of a poison being used (fig.4), in 136 incidents. During the 1990s, fenthion (an organothiophosphate insecticide) was the most frequently abused substance, associated with baits used illegally to protect lambs from foxes and crows (RSPB 1990); fenthion accounted for 30% of confirmed poisoning incidents in that decade. During 2000-09, the compound most frequently abused was alphachloralose (a rodenticide), which accounted for 36% of incidents during that decade. Bendiocarb (a carbamate insecticide) was the most frequently encountered pesticide in 2010-19, involved in 50% of incidents, and was numerically the most significant during the 30-year review period. Bendiocarb featured in 23% of all poisoning incidents in Wales over the 30 years, and its abuse has increased significantly across Britain since 2010.

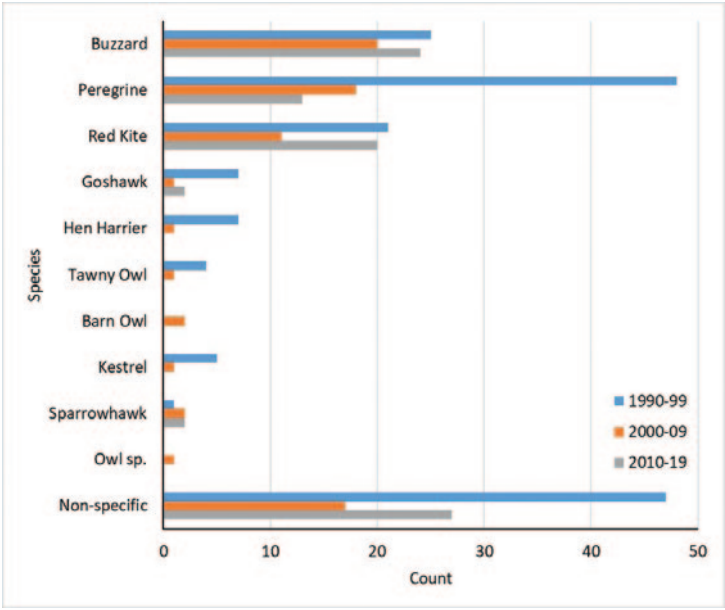


Figure 3. 'Count' is the number of persecution victims by species (where known) and the number of "non-specific" incidents where no victims found or where victim number is not known, 1990-2019.

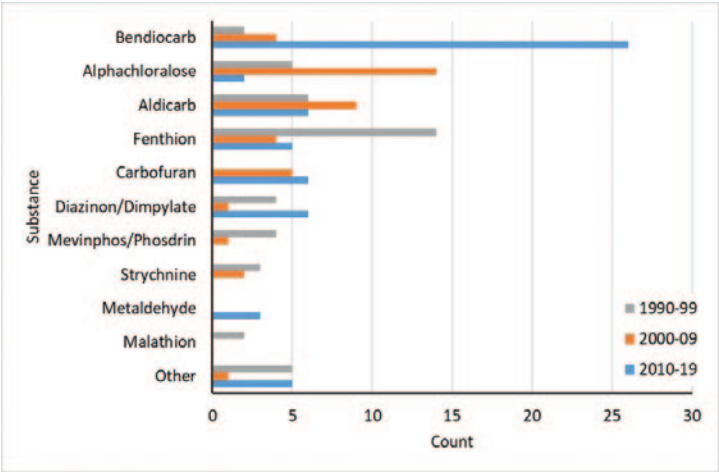


Figure 4. Substance analysis results in confirmed raptor persecution poison/pesticide abuse incidents recorded in Wales, 1990-2019. Some incidents involve multiple substances, so these figures are higher than total number of poisoning incidents. 'Other' comprises Brodifacoum (1), Benfuracarb (1), Carbaryl (1), Carbosulfan (1), Isofenphos (1), Methomyl (1), Endrin (1), Phosmet (1), Propetamphos (2), Oxamyl (1) and an anaesthetic used for dehorning cattle (1).

The number of confirmed persecution incidents was, across Wales, lower in the third decade of the study than the first, but the change was not uniform across the country (fig.5). During 1990-99, in order of magnitude, the vice-counties with the highest levels of raptor persecution were Denbighshire, Ceredigion, Montgomeryshire and Meirionnydd; together these four counties accounted for 51% of the total. Persecution levels in all four counties fell during the following two decades, and in 2010-19 those counties accounted collectively for 33% of the total. The change in areas that formerly had high rates of persecution has driven the reduction across Wales.

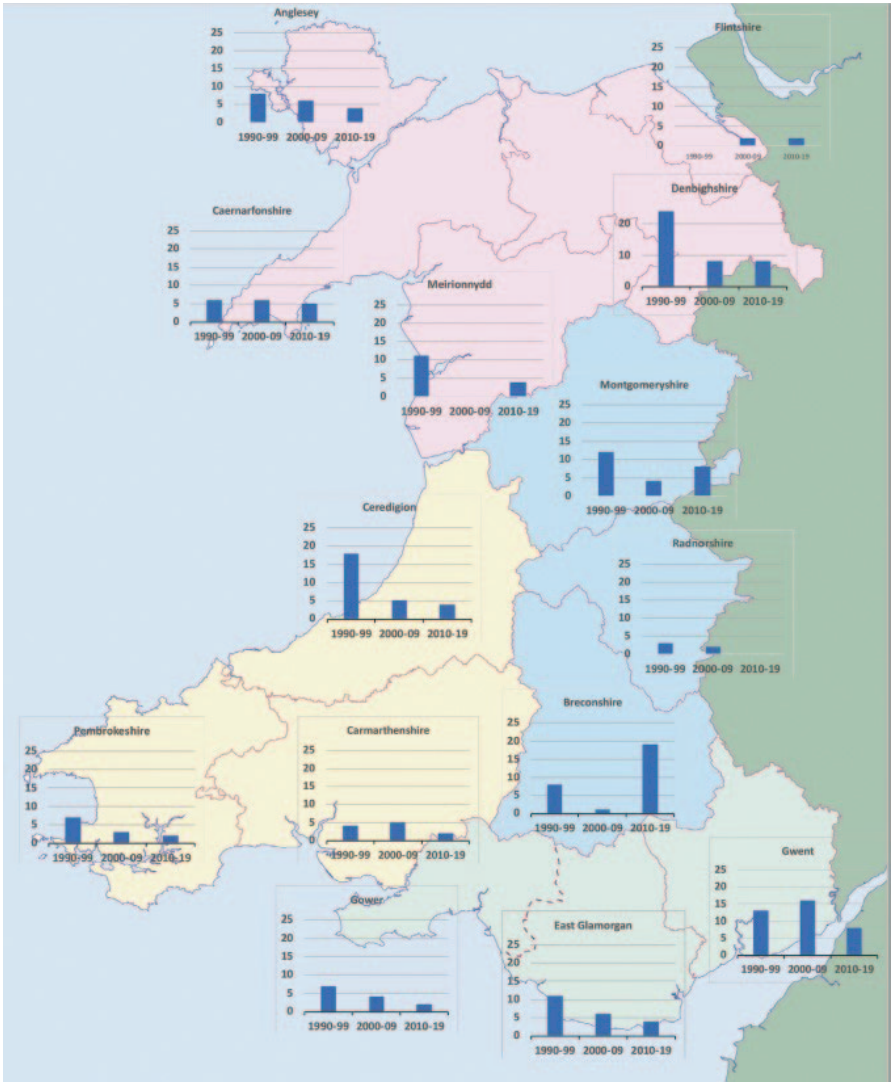


Figure 5. Number of confirmed raptor persecution incidents in Wales by vice-county, 1990-2019.

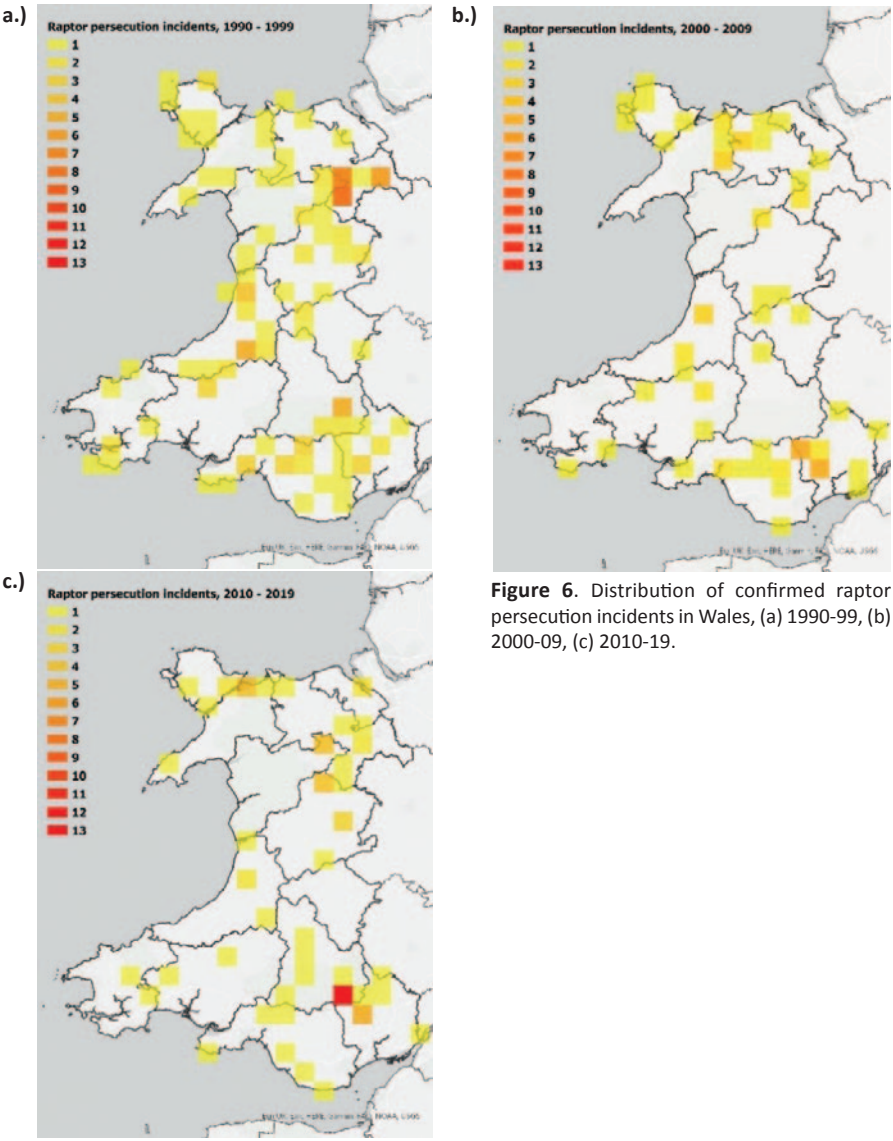


Figure 6. Distribution of confirmed raptor persecution incidents in Wales, (a) 1990-99, (b) 2000-09, (c) 2010-19.

Notable as the only county where an increase occurred over the three decades is Breconshire, where there were eight confirmed incidents in 1990-99 and 19 in 2010-19. Of those 19 incidents, 13 were in one area during 2012/13, which involved the discovery of seven Pheasants used as baits containing Bendiocarb, and five dead Red Kites and eight Buzzards that also contained Bendiocarb. This series of incidents resulted in SO11, centred on the Glanusk Estate, being the area with the worst record for illegal raptor persecution in Wales during the 30-year period. The areas with the next highest concentrations of confirmed incidents were the 10-km squares SJ13 (n=11) around Llanarmon Dyffryn

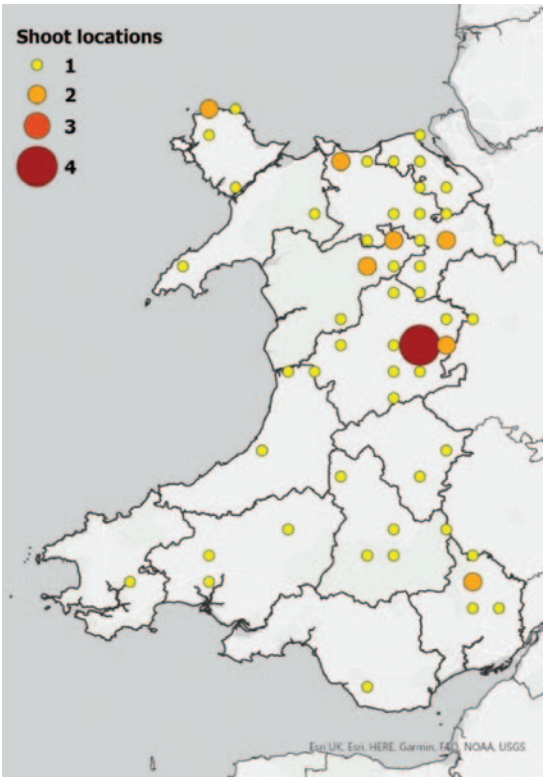


Figure 7. Distribution of 'commercial' shoots of Pheasant, Red-legged Partridge and Red Grouse by 10-km square, defined as those that sold shooting days on the website **gunsonpegs.com** in January 2021.

Ceiriog, Denbighshire, the adjacent SJ14 (n=8) around Llangollen, Denbighshire, and ST29 (n=8) west of Cwmbran, Gwent.

The spatial distribution of persecution incidents (fig.6) shows that raptor persecution has become less widespread over time, although importantly the rates of detection in each area are not known. In the latter decade of the study period (2010-19), there was a strong association between the occurrence of persecution events in 10-km squares and the presence of land managed for game shooting (fig.7) (logistic regression: est. = 1.40, s.e. = 0.365, p = 0.0001). The predicted probability of a persecution event occurring in a 10-km square during this period (fig.8) was three times higher in squares with game shoots (0.31, 95% CIs: 0.202-0.442) than those without (0.10, 95% CIs: 0.067-0.145).

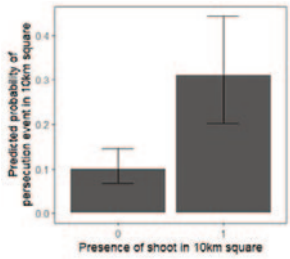


Figure 8. Predicted probability of a persecution event occurring in a 10-km square without driven gamebird shooting (0) and with driven gamebird shooting (1), based on data shown in figs 6c and 7.

Egg-theft (collecting)
There were 144 incidents of thefts (or attempts to take eggs) from nests in Wales recorded on the RSPB database during 1990-2019, of which 87 involved nests of birds of prey. Notably, of the remainder, 36 were thefts of clutches from Chough *Pyrrhocorax pyrrhocorax* nests between 1991 and 2008.

The 87 incidents involving birds of prey include two where it is uncertain whether it was eggs or chicks that were removed from Peregrine nests, and one unsuccessful attempt to take eggs from a Red Kite nest. The vast majority (83%) of incidents occurred during 1990-99, and there was only a single known egg-theft in the third decade of the review, a clutch of three Red Kite eggs taken in 2010 (fig.1).

Peregrine (51%) and Red Kite (38%) are the two species most targeted by egg-collectors, with Goshawk (9%) being the only other species for which multiple egg-theft was recorded (fig.9). Nest locations were known for 85 incidents, which occurred in all vice-counties except Gower, Pembrokeshire and Meirionnydd (fig.10). The counties with the greatest number of incidents were Ceredigion (25% of known locations), Caernarfonshire (15%) and Denbighshire (14%). The species targeted within each county reflect the strongholds of each species at the time. For example, 28 of the 33 Red Kite nests targeted were in Ceredigion, Breconshire and Radnorshire, which were the core counties for the species' presence during the 1990s (Gibbons *et al*. 1993). Peregrine distribution was more widespread than Red Kite, but nests in North Wales suffered higher levels of detected theft: 29 of the 45 (64%) incidents occurred in Caernarfonshire, Anglesey and Denbighshire, counties that held 26% of the population in 1991 (Williams 2018). It is evident that some nest sites were targeted repeatedly. Twelve Peregrine territories lost clutches in more than one year, as did seven Red Kite and two Goshawk territories.

Egg- and chick-theft (falconry)
There were 49 incidents of chick or egg thefts from nests in Wales during 1990-2019 where there was strong evidence that the motivation was use or sale into the falconry or aviculture trade. Of these, 48 involved raptors, the other being the removal of three chicks from a Chough nest, in 1997. The pattern over time was similar to that for egg theft, with 79% of the total occurring during 1990-99 (fig.1). Only one incident, involving a Red Kite nest in East Glamorgan in 2019, has been detected since 2010. Peregrines were particularly targeted, accounting for 83% of the total. Unlike egg-collecting, the counties with the highest number of incidents were all in the southeast: 50% of the total was in Gwent, East Glamorgan and Breconshire.

Discussion

We have taken a highly conservative view by using data only on confirmed incidents, which had to pass a high threshold to be included in the analysis. Despite this, it is important to acknowledge that using data of this nature to document temporal and spatial changes in the incidence of persecution comes with challenges and makes certain inherent assumptions.
(i) The dataset was collected through opportunistic findings by members of the public or RSPB staff.
(ii) The effort invested to detect persecution events has not been standardised between years or across different regions of Wales, and some of the temporal and spatial patterns found here will reflect this variation in effort.
(iii) The likelihood of detecting persecution events may have changed over time, and by location. It is possible that individuals perpetrating crimes against raptors have become more adept at hiding the evidence, so that it is less likely to be found and reported by members of the public. Our experience is that where there is sufficient evidence for the police to obtain a search warrant, this

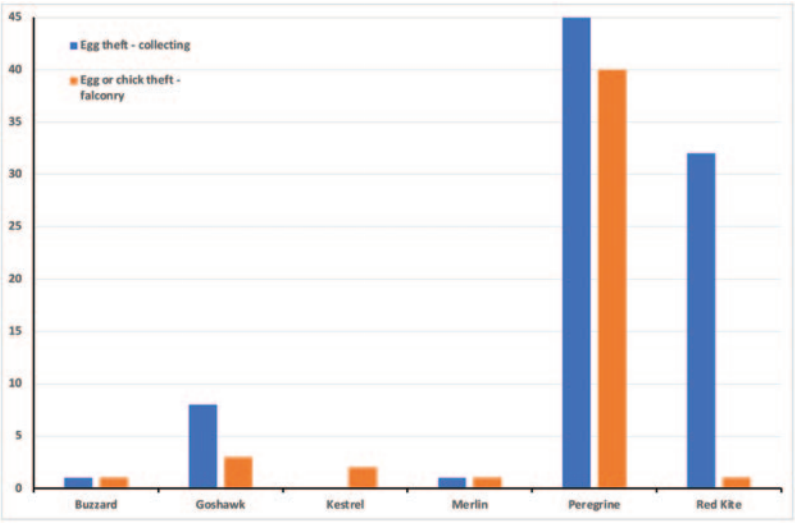


Figure 9. Birds of prey nests from which eggs and chicks were taken, by species, 1990-2019. Categorisation based on evidence described in Method. These include one failed attempt and two incidents in which it is uncertain whether eggs or small chicks were removed.

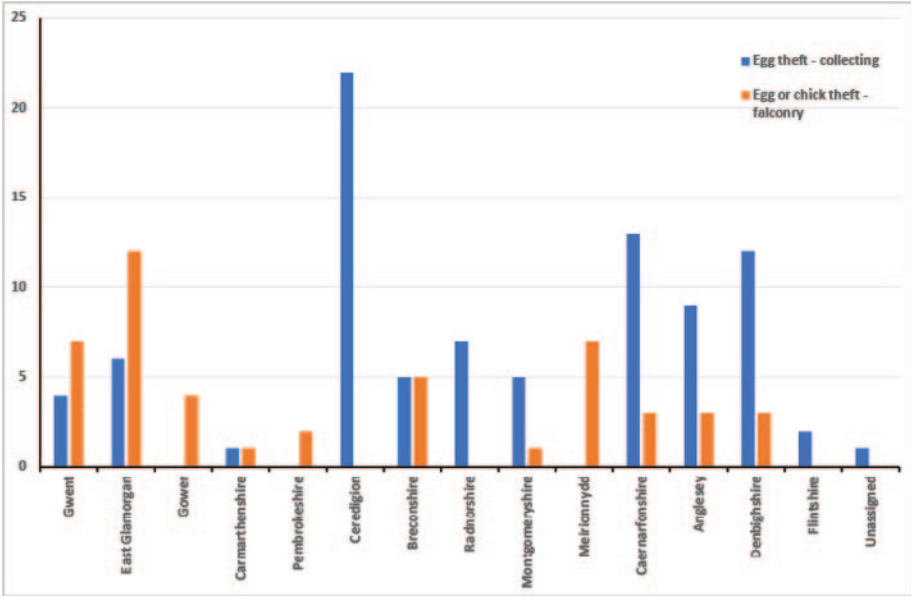


Figure 10. Confirmed egg- and chick-theft incidents involving birds of prey by vice-county, 1990-2019. Categorisation based on evidence described in Method.

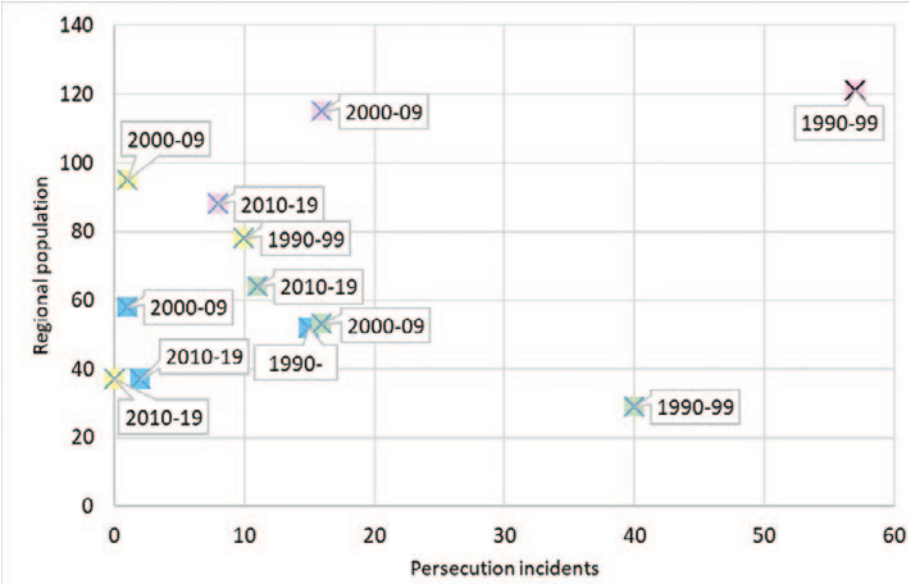


Figure 11. Relationship between incidents of all types involving Peregrine (in 1990-99, 2000-09 and 2010-19) and population estimates in four regions of Wales within each period (1991, 2002 and 2014). Pink = North, Blue = Mid, Yellow = West, Green = South (see fig.5).

results in a localised 'spike' in detected confirmed incidents (illustrated by the Glanusk Estate example above). These caveats should be borne in mind when contemplating the changes documented in this study.

Scale of persecution

Assessing the true scale of illegal persecution is challenging. Reported incidents are frequently described as the 'tip of the iceberg', but while we can measure the size of that 'tip', the number of offences not recorded remains unknown, since offences routinely take place in remote, quiet and private locations. However, long-term raptor monitoring and the use of satellite technology have shown that persecution continues to have a profound impact on numbers, distribution and breeding success of several raptor species in the UK, as illustrated below.

Intelligence received by the RSPB Investigations Team is not always possible to confirm, but includes, for example, reports of extensive persecution of Goshawks around Pheasant pens in South Wales as young raptors disperse from natal sites in mid-summer. Detailed information provided to the RSPB from gamekeepers and others within the shooting community suggest that more raptors are killed, undetected, each year on single 'worst' estates than are detected and confirmed as bird of prey persecution incidents for the entire UK. Based on GS's experience, the annual total of confirmed incidents in the UK is likely to be less than 1% of those taking place.

The poisoning of raptors continues to be of concern, both for the increase in incidence and its indiscriminate nature, as a single bait can kill multiple scavenging species of bird including Red Kite and Buzzard, wild mammals and household pets. The 'poison of choice' has changed by decade: strychnine in the 1980s (Cadbury 1992), fenthion in the 1990s, alphachloralose in the 2000s and

bendiocarb in the 2010s. While the sale and use of the pesticide products most regularly abused to poison raptors have been banned during the last three decades, products remain in circulation for many years and other poisons are available when stocks run out. The most concentrated formulation of bendiocarb was banned in December 2020 but is expected to remain a problem for many years. Effective enforcement of pesticide abuse continues to be necessary and tighter controls on possession of certain pesticides would be welcome.

We found a strong association between the occurrence of raptor persecution events in 10-km squares and the presence of land managed for driven shooting of Pheasant, Red-legged Partridges and Red Grouse. There may be unrelated explanations for this, which is worthy of further investigation. One hypothesis is that shooting interests are complicit in the illegal persecution of birds of prey in Wales, and there is a large body of evidence documenting the role of intensive management for gamebirds in the illegal persecution of raptors in the UK (e.g. Murgatroyd *et al*. 2019). Given the opportunistic way in which persecution events have been recorded, the data are potentially subject to currently unknown temporal and spatial biases, some of which may yield inadvertent associations between persecution events and the presence of shoots (e.g. greater efforts devoted to locating persecuted raptors near gamebird shoots). Quantifying the nature of such biases may allow greater confidence in attributing illegal persecution to shooting interests.

Egg-theft (collecting)

Egg-collecting was formerly a contributory factor to the loss or slow recovery of rare birds. During 1960-89, when the Red Kite population was far smaller than today, 72 clutches were known to have been taken in Wales, equating to 8.5% of all nesting attempts and assessed to have slowed down the rate of population growth by 0.6% each year (Bibby *et al*. 1990). Egg-theft has declined to vanishingly small levels, with no confirmed incidents in Wales since 2010, which reflects a huge reduction evident across the UK. The introduction of custodial sentences in 2001 and the subsequent high-profile imprisonment of several egg collectors seems to have had a dramatic deterrent effect.

Egg- and chick-theft (falconry)

In the 1980s and early 1990s, the taking of eggs and chicks for falconry was a significant problem for Peregrines and Goshawks in Britain. Taken from the wild, birds were reared, declared as 'captive-bred' and laundered into the falconry market. With each bird worth up to £1,000, substantial profits could be made. The RSPB pioneered the use of genetic profiling to challenge captive-breeding crimes (Shorrock 1998), which exposed widespread criminality and numerous individuals were convicted of laundering these two species. The high-profile imprisonment of two falconers for laundering large numbers of Peregrines appeared to have a strong deterrent effect, and taking offences for falconry significantly declined. Since 2000, there has been a huge increase in the sport of falcon-racing in the Middle East, which has increased the demand for raptors. In 2010, a man was intercepted at Birmingham Airport *en route* to Dubai with 14 Peregrine eggs taken from four nests in Wales, and was later jailed for smuggling offences. He reportedly stood to make £5,000 per bird.

Impact on raptor populations

In broad terms, the trends in human interference of raptors in Wales is similar to that across the rest of Europe. Direct mortality by humans on six migratory or partial-migratory raptor species reduced from 39% during 1906-79 to 8% in 1980-2014 (De Pascalisa *et al*. 2020). During 1990-2019, the populations of most species listed in fig.3 have generally been stable or declined in Wales.

There has been a significant and welcome recovery in Red Kites in Wales, by 413% since 1995 (Harris *et al*. 2020), although it could have recovered earlier in the absence of persecution and egg-collecting.

In Wales, 20 Red Kites were poisoned during 1971-89 (Lovegrove *et al*. 1990) which, although fewer than in 1990-91, occurred at a time when the population was smaller and less resilient. One might expect, with a larger Red Kite population and increased public awareness, more poisoned birds to be recovered if the impact of pesticide abuse on populations was constant.

The Peregrine population increased from 280 occupied territories in 1991 to 321 in 2002 but subsequently reduced to 279 in 2014 (Williams 2018). There was no obvious relationship in mid- or West Wales between the regional Peregrine population in 1991, 2002 and 2014 and the number of confirmed incidents (of all three types) targeting Peregrines during that decade (fig.11). In North Wales the population fell by 27% between 1991 and 2014 and the number of confirmed incidents detected has fallen by 91%. In South Wales, an increase in Peregrine numbers was concurrent with a reduction in the number of confirmed incidents detected. In 2000-19, of 917 breeding attempts monitored by the South Wales Peregrine Monitoring Group, 697 were successful (76%). Of all attempts, 6.5% (n=46) were attributed to illegal disturbance, most of which were intentional (Colin Richards *in litt*.). The breeding population in the SWPMG study area reduced by 15% during that period, but analysis was unable to assess the impact of human activity on breeding success (Dixon 2006).

Buzzard numbers in Wales declined by 8% during 1995-2019 (Harris *et al*. 2020). Elliott and Avery (1991) showed that illegal persecution of Buzzards was more likely to be reported at the edge of its range, which at the time was restricted largely to the uplands of western Britain. Their study, which pre-dates this review, found that 39 Buzzards were killed illegally in Wales during 1975-87, of which 29 were poisoned, eight shot and five killed by pole-trap. This suggests that illegal persecution had been detected at a similar level in the decade or so preceding 1990-99.

The species whose population is at the greatest risk from illegal persecution in Britain is Hen Harrier, particularly where they nest or hunt on moorland managed for driven grouse-shooting (e.g. Murgatroyd 2019). Hen Harriers re-established as a breeding species in Wales in the 1960s following a half-century absence resulting from persecution. The population increased from 27 pairs in 1989 to 57 pairs in 2010 and then fell back to 32 pairs in 2016 (Wotton *et al*. 2018). Interference with nests in Wales was associated with sites where gamekeepers were employed, but appeared to cease in the late 1990s onwards, concomitant with an increase in both productivity and population abundance (Whitfield and Fielding 2009). During 2017-19, 12 chicks that fledged in North and mid-Wales were fitted with tags, of which 11 died before the following breeding season. Seven were judged to have died of natural causes and the cause of death of another was uncertain. Of the other four, one was almost certainly killed illegally and another two ('Heulwen' and 'Aalin') disappeared in highly suspicious circumstances near Ruabon Mountain, Denbighshire, in 2018 (Pritchard *et al*. 2021). The sample size is small but suggests that illegal persecution contributes to low survival rates of Hen Harriers in Wales in their first year.

Of the other raptor species that have been victims of crime, Goshawk has increased its breeding range, and presumably its numbers, significantly since its re-establishment (Balmer *et al*. 2013). Populations of Sparrowhawk and Kestrel have fallen since 1995, by 22% and 35% respectively in the UK, but no data are available separately for Wales (Harris *et al*. 2020). The proportion of Tawny Owl territories occupied in Wales has fallen from 62% in 1989 to 53% in 2018 (BTO Tawny Owl Point Survey, unpubl. data) and the number of Barn Owls is thought to be stable (Pritchard *et al*. 2021).

Raptor crime-related prosecutions in Wales

Although it did not form part of the analysis, other data from the RSPB show that of 14 convictions

for raptor persecution in Wales relating to this period, six were employed as gamekeepers, two were farmers and one was a builder; of the five for which employment was not known, three were involved in pigeon-racing. There were a further two convictions during this period for the possession of illegally-killed raptors, where the persecution (incident) date and location within Wales are unknown. There were 16 convictions relating to the taking of eggs and chicks in Wales during the period: 12 classed as egg-theft (collecting) and four as egg- and chick-theft (falconry). Nine of the 16 (56%) occurred during 1990-99 and only two convictions were during 2010-19, reflecting the reduction in these types of incidents.

In conclusion, the number of confirmed incidents indicates the virtual cessation of egg- and chick-theft and there has been a welcome decrease in levels of detected illegal persecution across most of Wales. The number of confirmed persecution incidents in Wales is around 10% of the total for Britain over this 30 year period, and has been reducing relative to England and Scotland. Welsh incidents comprised 15% of the UK total in 1990-99, 7% in 2000-09 and 8% in 2010-19. The effort in monitoring nesting raptors and the resources applied to wildlife crime detection in Wales may have varied over time and been lower than in other parts of Britain.

There remains a persistent problem, especially of illegal poisoning, that requires government attention, more coordinated enforcement effort and consideration of new legislation and sanctions. The continued abuse and misuse of pesticides and poisons is worrying, and as populations of several raptor species have declined in Wales over the last 10-25 years, even if for other reasons, the removal of small numbers from their populations may have consequences for their resilience.

Acknowledgements

Our thanks to Steven Ewing for his help with the analyses; South Wales Peregrine Monitoring Group, which provided summary data cited in this paper; Paul Britten and Ian Spence (who used DMAP by Dr A.J. Morton) for producing the maps; and Sophie Lee-Williams, who provided valuable comments on an early draft.

References

Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. and Fuller, R.J. (Eds.) 2013. *Bird Atlas 2007-11; the breeding and wintering birds of Britain and Ireland*. Thetford: BTO Books.

Bibby, C., Robinson, P. and Bland, E. 1990. The impact of egg collecting on scarce breeding birds. *RSPB Conservation Review* 4: 22-25.

Cadbury, J. 1992. This illegal killing must stop: a review of bird of prey persecution and poison abuse. *RSPB Conservation Review* 6: 28-35.

De Pascalisa, F., Panucciob, M., Bacaroc, G., and Montib. F. 2020. Shift in proximate causes of mortality for six large migratory raptors over a century. *Biological Conservation* 251: 108793.

Dixon, A., Richards, C., Haffield, P., Lawrence, M., Thomas, M., Roberts, G. and Lowe, A. 2006: Peregrine (*Falco peregrinus*) population trends in south-central Wales. *Welsh Birds* 4: 433-441.

Elliott, G. D. and Avery, M. I. 1991. A review of reports of Buzzard persecution 1975–1989. *Bird Study* 38: 52-56.

Gibbons, D.W., Reid, J.B. and Chapman, R.A. 1993. *The New Atlas of Breeding Birds in Britain and Ireland*: 1988-1991. Poyser, London.

Harris, S.J., Massimino, D., Balmer, D.E., Eaton, M.A., Noble, D.G., Pearce-Higgins, J.W., Woodcock, P. and Gillings, S. 2020. *The Breeding Bird Survey 2019*. BTO Research Report 726. Thetford: British

Trust for Ornithology.

Kenward, R. 2006. *The Goshawk*. Poyser, London.

Lovergrove, R., Elliott, G. and Smith, K. 1990. The Red Kite in Britain. *RSPB Conservation Review* 4: 15-21.

Lovegrove, R. 2007. *Silent fields: the long decline of a nation's wildlife*. Oxford University Press.

Murgatroyd, M. Redpath, S.M., Murphy, S.G., Douglas, D.J.T. Saunders, R., and Amar, A. 2019. Patterns of satellite tagged hen harrier disappearances suggest widespread illegal killing on British grouse moors. *Nature Communications* 10: 1-8.

Pritchard, R., Hughes, J., Spence, I.M., Haycock, R. and Brenchley, A. 2021. *The Birds of Wales*. Liverpool University Press.

RSPB. 1990. *Persecution: Birds of Prey and Owls killed in the UK 1979-1989*. Sandy.

RSPB. 2020. *Birdcrime 2019.* Sandy, Bedfordshire. **https://www.rspb.org.uk/birds-and-wildlife/advice/wildlife-and-the-law/wild-bird-crime/birdcrime-report-2019/**

Shorrock, G. 1998 The success of DNA profiling in wildlife law enforcement. *International Journal of Bioscience Law* 1: 327–341.

Whitfield, D.P., Fielding, A.H., McLeod, D.R.A. and Haworth, P.F. 2008. *A conservation framework for golden eagles: implications for their conservation and management in Scotland*. Scottish Natural Heritage Commissioned Report No.193.

Williams, G. 2018. The Breeding Population of the Peregrine (*Falco peregrinus*) in Wales in 2014. *Birds in Wales* 15: 3-8.

Whitfield, D.P., Fielding, A.H. and Whitehead, S. 2008. Long-term increase in the fecundity of Hen harriers in Wales is explained by reduced human interference and warmer weather. *Animal Conservation* 11: 144-152.

Wotton, S.R., Bladwell, S., Mattingley, W., Morris N. G., Raw, D., Ruddock, M., Stevenson, A. and Eaton, M.A. 2018. Status of the Hen Harrier Circus cyaneus in the UK and Isle of Man in 2016. *Bird Study* 65: 145-160.

Peregrine with chicks: Chris Gomersall (rspb-images.com)

Features of the nests of Buzzards *Buteo buteo* in north-east Wales, 1978-2011

John Lawton Roberts[1] and the late Michael Stanley Jones
[1] 1, Horseshoe Pass View, Brook Street, Llangollen, Denbighshire LL20 8LU
jzroberts124@btinternet.com

Crynodeb

Mewn papur blaenorol (Roberts a Jones 2009) adroddasom ar niferoedd, pellter rhwng nythod a llwyddiant nythu'r Bwncath mewn ardal o ucheldir yng ngogledd-ddwyrain Cymru. Rydym yn awr yn disgrifio agweddau eraill o'u nythu, yn bennaf y nythod, ond hefyd adwaith yr oedolion i ni yn eu harchwilio. Cofnodasom 308 o nythod gwahanol mewn 55 tiriogaeth Bwncath, a ddefnyddiwyd mewn 434 ymgais nythu rhwng 1978 a 2011. Ar gyfartaledd, roedd y nythod 247 medr uwch lefel y m□r (rhwng 64 a 410m) a'r uchder o'r ddaear ar gyfartaledd yn 12m (rhwng 3 a 27m). Defnyddiwyd o leiaf 19 rhywogaeth o goeden, gyda derw (27%) y mwyaf cyffredin, a choed llydanddail yn amlach na chonwydd o 56% i 44%. Roedd y rhan fwyaf o nythod mewn coedydd, yn enwedig planhigfeydd conwydd a choedlannau llydanddail, yn hytrach na chaeau neu wrychoedd. Fel rheol roedd y nythod ar ffyrch trwchus, 56% ar y prif foncyff a'r gweddill ar ganghennau. Nid oedd unrhyw berthynas amlwg rhwng cyfartaledd y cywion a fagwyd a maint y nyth. Y cyfnod hwyaf y bu nyth mewn defnydd oedd naw mlynedd, a'r cyfnod parhaus hwyaf yn chwe blynedd. Roedd y canghennau ffres a osodwyd ar y nyth gan yr oedolion yn bennaf yn fytholwyrdd (57%) yn ystod y cyfnod gori a llydanddail (71%) pan oedd y cywion yn y nyth. Llarwydden oedd y rhywogaeth fwyaf cyffredin yn y ddau gyfnod. Cadarnhawyd presenoldeb stwbiau byr o ganghennau marw wedi eu torri, gyda marciau torri ffres arnynt, gerllaw nythod Bwncath mewn 78% o 90 coeden, beth bynnag y math ar goeden. O'u mesur ar raddfa pum pwynt, roedd adwaith wan gan y rhieni i ni'n ymweld â nyth yn amlach nag adwaith cryf o 4:3 yn ystod gori, ond roedd y gwrthwyneb (1:2) yn wir pan oedd cywion yn y nyth, "Ymosododd" oedolion arnom ger eu nythod mewn wyth tiriogaeth nythu mewn uchafswm o tri tiriogaeth mewn un flwyddyn.

Abstract

In an earlier paper (Roberts and Jones 2009) we reported on numbers, spacing and breeding production of Buzzards in an upland area in north-east Wales. We now describe other aspects of their breeding, primarily nests, but also reactions of adults to our inspection of these. We recorded 308 different nests in 55 Buzzard territories, which were used in 434 breeding attempts between 1978 and 2011. Mean altitude of nests was 247 m a.s.l (range 64-410m) and mean height above ground was 12m (range 3-27m). A minimum of 19 tree species was used, with oaks *Quercus* spp. (27%) being most frequent and broad-leaved trees outnumbering conifers by 56% to 44%. Most nests were in woods, especially conifer plantations and broadleaved copses, rather than fields or hedgerows. Nests were mainly on thick forks, 56% of which were on the main trunk with the rest on branches. There was no apparent relationship between mean fledged brood size and nest dimensions. The maximum duration of use of any nest was nine years, and the longest continuous use was six years. Fresh foliage placed by adults on nests was mainly evergreen (57%) during incubation and deciduous (71%) during the nestling period. Larch *Larix decidua* fronds were most frequent in both periods. Presence of short stubs of dead, broken-off branch stems, with fresh cut-marks on them, was confirmed next to Buzzard nests in 78% of 90 trees, irrespective of tree type. Measured on a five-point scale, weak reactions by parent birds to our visiting of nests exceeded strong reactions by 4:3 during incubation, but the reverse (1:2) applied during the nestling period.

Adults 'attacked' us near their nests in eight breeding territories, in a maximum of three territories in one year.

Introduction

The Buzzard *Buteo buteo* is now the most numerous diurnal raptor in Wales, its success ascribed, variously, to reduced persecution, increased Rabbit *Oryctolagus cuniculus* numbers, notably in the east and to the species' adaptability in a largely anthropogenic landscape (Sim *et al*. 2001; Roberts and Jones 2009; Driver and Dare 2009; Pritchard *et al*. 2021). Aspects of Buzzards' nests in or near Wales were reported from Snowdonia and Migneint/Mynydd Hiraethog (Dare 1989) and from Avon (Prytherch 2016). Comprehensive collations of British and pan-European study findings have been published in recent monographs (Dare 2016, Walls and Kenward 2020).

In 2009, we reported on numbers, spacing and breeding output of Buzzards in an upland area of north-east Wales in the period 1978-2008 (Roberts and Jones 2009). By 2008 our 95km^2 study area held 49 breeding territories. From 2009 six new breeding territories were established by in-filling. Using the fuller dataset we now report on nest features and locations, and on the reactions of adult Buzzards to our visits. Intensity of parental reaction we look at in relation to breeding stage (incubation *vs* chick rearing) and outputs (clutch and fledged brood sizes).

Methods

The study area covers c. 95 km^2 of enclosed, mainly upland farmland, bordering on open moorland, at between *c*. 110-565 m a.s.l. It lies west of the Dee plain in Wrexham and north of the Dee itself in Denbighshire. By 2011 we had identified 55 breeding territories, of which 30 included sections of open moorland and 25 comprised fenced farmland only. A fuller description of habitats and land use has been given elsewhere (Roberts and Jones 2009).

Buzzards' nests were located by searching suitable sites and observing the behaviour of pairs. Nests were entered on 1:25,000 maps, a process aided from 2003 by use of a GPS unit. We recorded tree species, location (copse, larger wood, hedgerow etc.), position of nest in the tree and height of the nest above ground level (estimated using height of climber, ladder or length of rope). With few exceptions nests were accessed at least twice to measure eggs and ring young and record nest size, greenery and other items added to the nest by the adults. In cases where fewer young were observed fledged than had been ringed, a third visit was made to check for casualties. Estimates of habitat and tree availability were made using our extensive local knowledge of the composition of Buzzard territories in the study area.

On each visit we recorded reactions of Buzzard parents to our nest visits or, in the case of non-breeding birds, to our presence in their territories (Table 1). Where more than one nest visit was made at either egg or nestling stage, the stronger reaction category is used in calculations.

Category	Definition.	Classification
A	No calls. Bird/s not seen, or only later and in distance	Weak
B	Bird/s seen, but silent, or distant and very few calls	Weak
C	Bird/s called several times, but not persistently or at close range	Moderate
D	Bird/s called persistently and at close range	Strong
E	Bird/s attacked: approached to <3m from, or struck, us with talons	Severe

Table 1. Categories and classifications of Buzzard reactions to surveyor presence.

Results

Nest sites

We recorded 308 different nests in 55 Buzzard territories, which were used in 434 breeding attempts between 1978 and 2011, giving an average of 1.4 uses per nest. A total of 147 sites were used only once. In the 276 cases where we know which nests were used in two or more successive years, 219 (79%) involved a change of site between years. Pairs in our two longest monitored territories have each made 22 uses of, respectively, 17 and 14 nests. By contrast, only eight sites were used in 20 layings at another territory, where one nest was used nine times, including in six successive years, the longest span in our study.

The arrangement, and spacing of nest sites within territories varied markedly. Of 45 territories with more than two sites, 32 had most nests clustered into a radius of <500m, while eight had most nests concentrated into two main, well-separated groupings. The mean maximum separation within a cluster was 0.377 km and that of nests within a territory was 0.602 km, this including five cases exceeding 1 km spread. Nests were most closely clustered (at radius < 0.2 km) in territories (20) with larger woods or where one wood only, even relatively small, was available. Spacing was wider in territories (17) on more open hillsides with several clumps of trees. The relative narrowness of even the two largest conifer plantations meant that most nests were close to the outer edge. The remainder were mostly near rides wide enough to allow unhindered access for Buzzards.

The average altitude of 308 nest sites was 247m a.s.l., range 64 to 410m. Nest height above the ground varied greatly, from 3 to 27m, average 12m (n=308). Active nests were found in a minimum

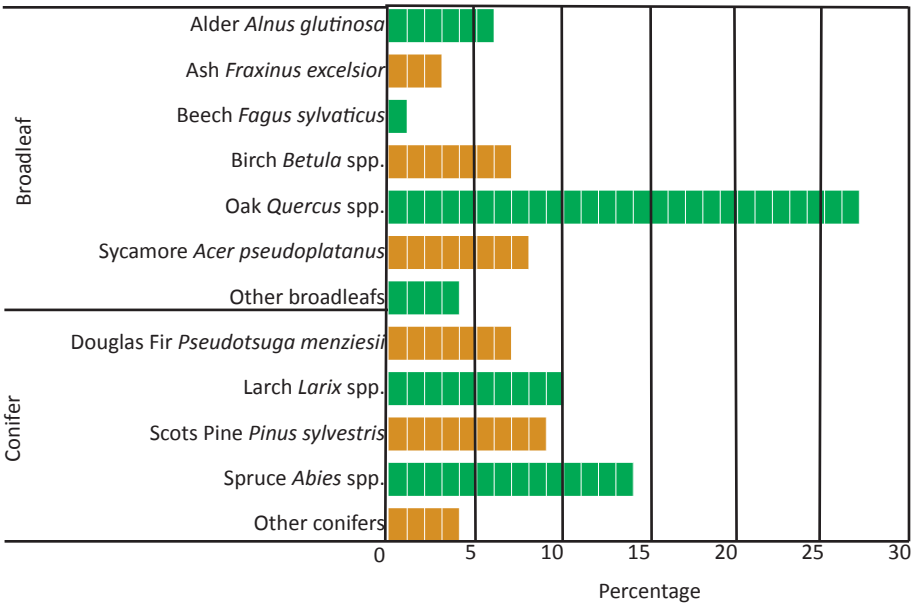


Figure 1. Tree species holding Buzzard nests in north-east Wales (n=308). 'Other breadleafs' = Wild Cherry *Prunus avium* (n=2); poplar *Populus* spp. (n=2); Sweet Chestnut *Castanea sativa* (n=4); hybrid lime *Tilia* spp. (n=4). 'Other conifers' = pine *Pinus* spp. (n=8); Western Hemlock *Tsuga heterophylla* (n=4).

of 19 tree species in 308 sites used in 434 breeding attempts with nests in broadleaves (56%) found more often than those in conifers (44%), roughly reflecting their occurrence in the study area. Nests in oaks (27%) were found twice as frequently as any other tree (Fig.1). Only 7% of nest trees were heavily clad in Common Ivy *Hedera helix*.

The majority of nests (89% of 305) were in woods, the rest in fields, in or away from hedgerows. Overall, categories of wood were used roughly in proportion to their availability within territories. More nests (31%) were in conifer plantations than elsewhere. Copses or belts of trees following stream courses - either broadleaved, coniferous, or a mixture of these - made up most other sites, though larger broadleaved or mixed woods were also frequently used (Fig.2). Although both natural cliffs and quarries were present in the area and more than half of all territories included areas of open moor, no cliff nest was found and only one nest (out of 305) was found on moorland - in a Sycamore overhanging a small disused slate quarry. A single nest in a small, well wooded quarry, at the base of a Rowan *Sorbus aucuparia* growing from the rock face, was used twice.

In 2009, Buzzards reared at least one young to fledging in a medium-sized garden c. 40m from an occupied house. In the next two years they bred in more typical sites.

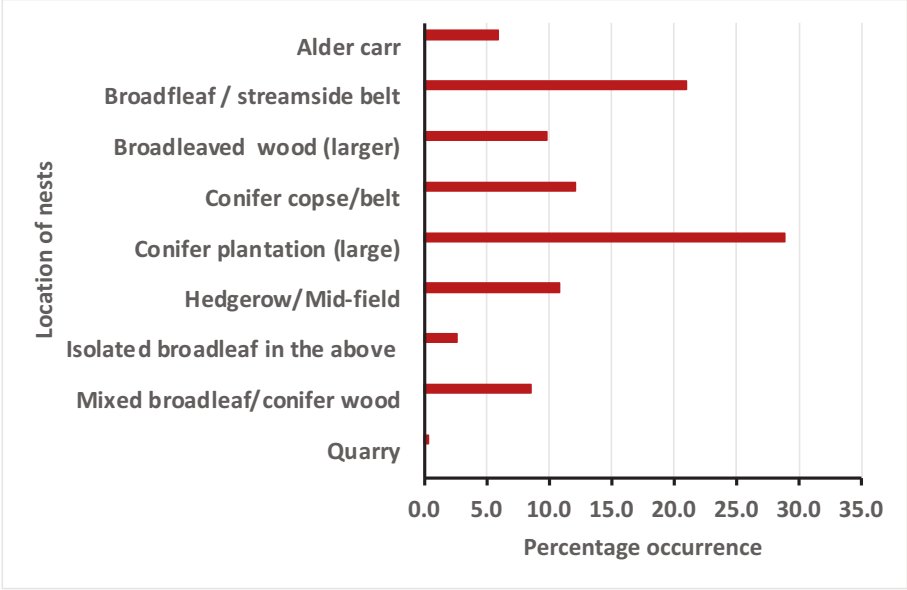


Figure 2. Locations of Buzzard nests in north-east Wales between 1978 and 2011.

Nest locations in trees

We recorded the position in the tree of 305 nests, used in 431 breeding attempts (Fig.3). Most nests in broadleaved trees, and in conifers in more open woods, were built in strong forks, situated either on the main trunk or on a thick, spreading bough. In straight-trunked plantation conifers they were more commonly set against the trunk around two-thirds up the tree, at or just above where strong, live branches circle the trunk. Some were in similar positions under the crown. Others were in more open situations: on bent-over tops of trees, mostly larches, or on the flat crown of a tree, usually

Douglas Fir, where the original top section had broken away. Two rested on nearly horizontal trunks of trees growing out of steep banks and two were in thin branches in the highest forks, positions reminiscent of Rooks' *Corvus frugilegus* nests. One such, the highest in the study, was in the topmost twigs of an avenue lime *Tilia* spp. and another was actually on a disused Rook's nest in an Alder. In six cases, one just outside our study area, old tree nests of Ravens *Corvus corax* were used, all set on strong boughs against the trunk in conifers and in different territories.

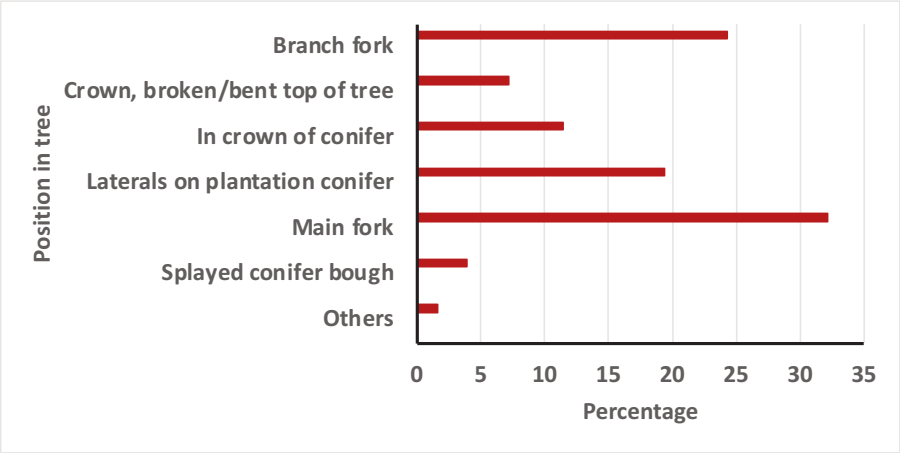


Figure 3. The positions of Buzzard nests in host trees.

Nest structure and materials

Most Buzzards' nests in our study, whether bulky or flimsy, were recognizable at a distance by their rather plate-like shape, with an opaque, deeper centre spreading into a thin peripheral platform of longer sticks. Conifer branches - especially of Larch – usually protruded at the sides. As with most other raptors' nests, from prior to egg-laying down flecks caught on or near the nest were a nearly invariable sign of occupation, if not actual breeding.

No precise measurements of size were made, but Buzzards' nests in this study can be roughly divided into two types: broad, deep, bulky 'traditional' structures and small, comparatively shallow platforms that are often adaptations of Carrion Crow *Corvus corone* nests or Grey Squirrel *Sciurus carolinensis* dreys. Bulky nests averaged 2.0 uses per nest compared with 1.12 uses each for shallow nests. Average clutch and fledged brood sizes from the two categories did not differ significantly.

Lining mostly comprised short tussocks of dead grass, rush (especially Soft Rush *Juncus effusus*) or both, complete with rootlets but usually without soil, and often included pieces of dead Bracken *Pteridium aquilinum* and dead, broader leaves of sedge *Carex*, rush *Juncus* or wood-rush *Luzula* species.

The majority of nests in our study had fresh green foliage added to them before and during incubation and through to fledging. Most of this consists of leafy shoots of trees or shrubs. A total of 939 instances of such 'greenery', identified *in situ* at species or group level on our Buzzards' nests - 500 from the incubation period, 439 from nests with young – were identified (Table 2). Larch predominated in nests of the former category, with conifers most frequent overall at 57%. However,

the high proportion of Larch means that deciduous species (58%) were found more often than evergreen. Conversely, in nests with chicks, broadleaved foliage outnumbered coniferous by 56:43 and, with Larch again most numerous, deciduous greenery formed 71% of the total.

Tree species		Total nests	
Common name	**Scientific name**	**Eggs in nest**	**Young in nest**
Cypress	*Cupressus* sp.	13	7
Douglas fir	*Pseudotsuga menziesii*	30	25
Larch	*Larix* sp.	100	72
Pine	*Pinus* sp.	71	30
Spruce	*Picea* sp.	61	43
Western hemlock	*Tsuga heterophylla*	16	14
Total conifers		**291**	**191**
Alder	*Alnus glutinosa*	22	37
Ash	*Fraxinus* sp.	13	56
Birch	*Betula* sp.	66	72
Cherry	*Prunus* sp.	2	2
European beech	*Fagus sylvaticus*	11	12
Hawthorn	*Crataegus monogyna*	2	6
Hazel	*Corylus avellana*	3	
Holly	*Ilex aquifolium*	3	2
Horse chestnut	*Aesculus hippocastanum*		2
Ivy	*Hedera helix*	15	7
Laurel	*Laurus* sp.	1	
Lime	*Tilia* sp.		2
Maple	*Acer campestre*	1	1
Oak	*Quercus* sp.	22	0
Rhododendron	*Rhododendron ponticum*	1	
Rowan	*Sorbus aucuparia*	6	7
Sweet chestnut	*Castanea sativa*		2
Sycamore	*Acer pseudoplatanus*	37	34
Willow	*Salix* sp.	4	6
Total broadleaved		**209**	**248**
Total evergreen		**211**	**127**
Total deciduous		**289**	**311**

Table 2. Tree foliage placed on Buzzards' nests in north-east Wales, 1978-2011.

Other additions in the plant category included lumps of bright moss; freshly gathered fronds of Broad Buckler Fern *Dryopteris dilatata* at two nests in different territories; a frond of Hard Fern *Blechnum spicant*; two whole plants of Common Nettle *Urtica dioica;* and one of a speedwell *Veronica* sp.

Harder plant material included nine pieces of bark of birch *Betula* spp. up to 6-8 cm square, nine bunches of dried ash 'keys' and a Douglas Fir cone. Of animal origin, we found a lamb's tail (amputated by the rubber ring method soon after birth), clean, fresh sheep's wool, a length of horse tail and four flat manure pieces, at least one of which was collected when freshly spread.

Like Red Kites *Milvus milvus*, though less often, Buzzards in our study incorporated human artefacts into their nest structures. These have included pieces of plastic bale wrapper (black or green), black bin bags, supermarket bags, a small birthday greetings gas-balloon, baler twine (white, red and blue) and thick blue nylon rope. Larger lengths of twine or big pieces of plastic sometimes dangled from nests, the latter flapping noisily in strong wind.

Occurrence of 'gnawed' branch stubs beside nests

We noted the presence, on the tree trunk beside Buzzards' nests, of short stubs of branches with clear signs of recent gnawing, apparently by a sharp beak. These were always on the side of the trunk adjacent to the nest and within reach of it by a sitting or standing Buzzard. They were normally <1cm thick and of range 4-8 cm in length. Similar stubs below, behind or above the reach of a standing Buzzard showed no signs of such apparent beak work. The stubs occurred beside 78% of nests (n= 90) checked by us in the period 2009-2011 and averaged 1.5 per nest, with similar numbers on broadleaved (37) and coniferous trees (33). Wondering whether these stubs might be obstructing the sitting bird and the cuts were her attempts at removing them, in the period 2009-2011 we checked the positions of 135 such stubs on 66 trees and found 85 clearly not obstructing, 11 possibly obstructing and 20 of uncertain status.

Reaction of Buzzards to surveyors

Individual Buzzards reacted differently to our presence at and near their nests. These reactions varied within pairs, within and between years and according to whether nests contained eggs or young Fig.4). Overall, weak reactions at egg stage (42%) were markedly more frequent than strong reactions (27%), while at chick stage the reverse was the case (47% strong and 25% weak). At both stages occurrence of moderate intensity reactions showed little proportional difference (26% and 22% respectively). Weak responses were associated with smaller mean clutch and fledged brood sizes than other categories (Fig.5).

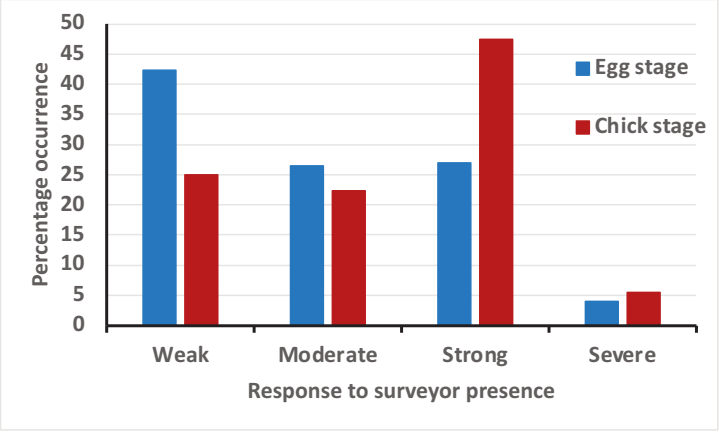


Figure 4. Reactions of Buzzards to surveyor presence at egg and chicks stages of the breeding cycle.

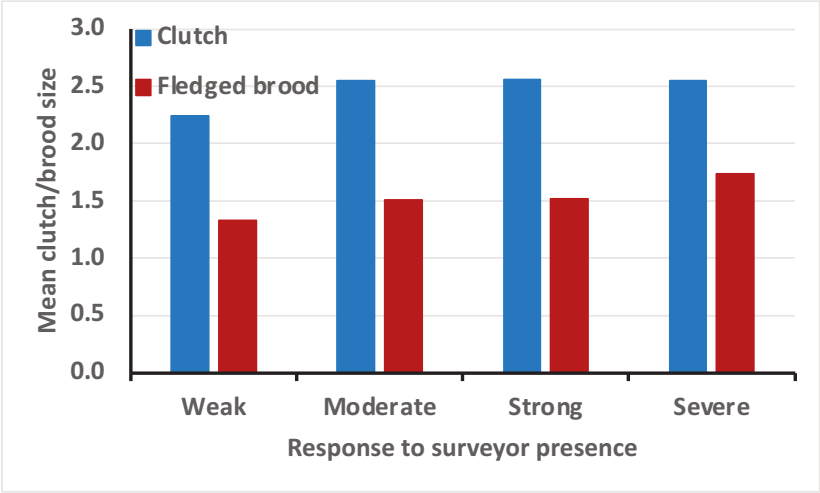


Figure 5. Clutch and fledged brood size relative to the strongest reaction to nest visits by surveyors when either eggs or young were in the nest.

At least three individual Buzzards, all apparently males, were involved in category E (Severe) over a period of 31 years across eight territories (Table 3). Incidents occurred during visits to 23 nests, in one active breeding territory where we failed to find the nest and one territory occupied by an apparently widowed male. Most attacks – in 14 years between 1990 and 2010 - were in territory T3 where its behaviour suggested that the male involved was the same bird. Of the six years when no attack occurred there, two saw no breeding, in two the reaction fell just short of 'attack' and in 2001 and 2006 no site visits were made by us.

	YEAR (19- and 20-)																		
Territory	80	83	90	91	95	97	98	99	00	02	03	04	05	07	08	09	10	11	Totals
T1	NV																		1
T2		NV																	1
T3			NV	NN	NV	NV	NV	NV	NV	NV	W	NV	NV	NV	NV		NV		14
T4															NV				1
T5										NV			NV						2
T6											NV			NV					2
T7																NV	NV	NV	3
T8																	NV		1
Totals	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	1	3	1	25

Table 3. Category E ('Severe'; Table 1) responses by Buzzards to human presence at nests in north-east Wales between 1980 and 2011. NV - nest visit made; NN - no nest found; WM - 'widowed' male present.

Incidents involving physical contact occurred mostly when the observer was alone. Most involved steep dives from behind, the bird striking with its talons at the back or top of the head. Waving a

stick above the head usually discouraged attack but simply holding the stick upright would cause the attacker to bank sharply and strike at the side of the head or at a bulging rucksack worn high on the back. Walking amongst bushes or under low branches made little difference as the birds could manoeuvre at extraordinary speed through these. The most effective deterrent was stopping and facing the attacker, although the attack resumed immediately the observer turned away and began walking. We were never attacked while climbing to nests, where the bird would usually perch some distance away, bobbing its head as it watched us. On one occasion it landed in the tree top and watched from there. The farmer, who passed through the territory often, was attacked only once, when he carried stakes on his shoulder near the nest (Eryl Hughes pers. comm.). Walkers also told local people how they were attacked on a road within the bird's territory, but at 100+ m distance from active nests.

In the territory adjacent to territory T3, occupied annually from 2003 and with no prior aggression shown towards us, a male made fierce attacks on us in 2009, always at a distance of at least 100m from the nest and on open hillside above it. It also attacked head-on, the only case we knew of in the whole study. In 2010 we were attacked in both territories by the respective males.

Discussion

Nest sites

All but one of our Buzzards' nests were in trees, these being abundant in all territories and giving concealment and comparative freedom from disturbance. Nearby crags and quarry faces were mostly bare and often disturbed by climbers, walkers or extraction operations. In Snowdonia, Dare (1989) noted that tall, exposed cliffs were mainly used above the tree line, whereas at lower altitudes Buzzards used trees or well-vegetated ledges on lower rock faces, often in woods. None of our Buzzard territories lacked ample trees for breeding.

The high variation in altitude of nests in our study reflects local relief. Many territories have an altitudinal range of over 200m. The height of nests above ground was close to that elsewhere in north Wales (Dare 1989) and in lowland Avon (Prytherch 2016). As in these two studies, oak was the most commonly used tree, though its proportional use was nearer to that in the Migneint-Hiraethog region in Dare's study where overall altitude and land-form more resembled our area's. In the rugged mountainous terrain of the Snowdonian section of Dare's study, oaks held above 50% of nests. Remarkably, deciduous trees in our study and in Migneint-Hiraethog held exactly 66% of nests. Numbers of Buzzards' nests in heavily ivy-clad trees in our study (7%) were too low to allow comparison with those in Avon (50%), where Prytherch (2016) found lower production of young than in trees without dense ivy. The low numbers of such nests found here is possibly due to a local campaign several decades ago to remove this plant. As in Dare's north Wales study, most nests were in woods, few in more open sites, again implying a concern for shelter and concealment. Exposure to wind and ease of location by nest predators like Carrion Crows probably explain this.

The substrate or supporting position of Buzzard nests in trees is often referred to (e.g. in Walls and Kenward 2020) but we have not found it quantified in the literature. The preference (75%) for strong forks on trunk or branches in more open sites, as also for the tough, lateral boughs that often ring the upper middle section of plantation conifers, must give maximum support from below and the side, important in resisting strong winds and when heavy young 'exercise' on the nest

Nest structure

We categorized our Buzzard nests crudely as bulky 'traditional' or shallow 'ephemeral' structures.

The former were re-used nearly twice as often as the latter and were probably advantageous in needing less time and fewer journeys to refurbish each season. Use of these, however, did not seem to be advantageous in terms of breeding success as clutch and fledged brood sizes from the two categories did not differ. In a more rigorous experiment, Prytherch (2015) found a significant increase in fledged brood size with greater surface area of nests in Avon.

A feature of Buzzards' nests often referred to but apparently not qualified or quantified in the literature is the placing of fresh green foliage on the nests throughout the breeding season, mostly outside the central cup. The habit is often explained in terms of marking territory ownership but its true function remains unknown (Walls and Kenward 2020).

Occurrence of 'gnawed' branch stubs beside nests
Apparently not mentioned in the literature, is the presence on the tree trunk close to Buzzards' nests of short stubs of thin, usually dead branches, seemingly cut at by a sharp, knife-like blade. In the absence of a more persuasive explanation, we wonder if the incubating or brooding female, awaiting feeds from the male, bites/nibbles at the nearest resistant objects close to her as a displacement activity.

Numbers, frequency of use and spacing of nests in territories
As in Dare's (1989) north Wales study, the number of old nests in each territory, the frequency of re-use, successive use and annual change of nest varied greatly and without any obvious explanation. Not surprisingly, the largest numbers of nests per territory in our study were in territories monitored over the longest period. Thus, also, our longest span of successive uses of a nest, six (or nine), is dwarfed by Julian Driver's record (*in litt*.) of a nest in almost continuous use for 45 years including 2020. As in the north Wales study (Dare 1989) nests occurred in clustered groupings, mostly - in both study areas - of *c*.250m radius and in both regions maximum separation of nests in some territories exceeded 1km.

Reaction of Buzzards
We know of no published attempt at quantifying different levels of reaction by Buzzards to visiting of their nests by humans. We found, not surprisingly given the greater duration of investment by the pair, that reactions were stronger with chicks rather than eggs in the nests. There was some evidence, too, that more eggs were laid and more young fledged from nests where reactions to human nest visits were bolder. However, the sample from Category E (Severe) comprised rather few individual birds and did not show increase in the case of clutch size.

Aggressive Buzzards striking people in Wales have been reported several times (Williams and Coan 1973, Driver 2004, Moore 2005, Pritchard 2020). Julian Driver's detailed account (*ibidem*) drew also on our experiences in north-east Wales up to 2003. In our study, as in his, it was apparently always male Buzzards that were the aggressors, though attacks by a female were reported from near Glynceiriog in Denbighshire by Williams and Coan (*ibidem*). That bird also attacked the authors from the front, as did a male in our study, while Driver was only attacked from behind (*ibidem*). Our T7 male was also unusual in that it only attacked us well outside the nest wood, ignoring our presence at the nest itself. That its territory adjoined territory T3, home to the male with the longest history of intense aggression, raises the possibility that these two birds were genetically related, as proposed by Driver (2004) for his two highly aggressive neighbour males.

Acknowledgments

At least 65 landowners, mostly farmers, and four gamekeepers welcomed us on the land and supplied

helpful information about 'their' Buzzards; J.Henson, H. Nash and Dr C.Jones helped us in the field; J.A.Jackson gave vital information, historical and current, about the study area's Buzzards; J.Driver and R. Pritchard commented helpfully on an earlier draft of the paper and, along with the late Robin Prytherch, shared their wide knowledge of Buzzards with us; and the Editor and I.M. Spence helped bring the paper to its final form. To all these we are most grateful. Our greatest debt of gratitude goes to Peter Dare. Without his patient, painstaking guidance this paper could not have been written.

References

Dare, P.J. 1989. Aspects of the breeding biology of the Buzzard *Buteo buteo* in North Wales. *Naturalist* 114: 23-31.

Dare, P. 2015. *The life of Buzzards*. Whittles, Dunbeath.

Driver, J. 2004. Exceptionally aggressive Buzzards in North Wales. *Welsh Birds* 4: 60-64.

Driver, J. and Dare, P.J. 2009. Population increase of Buzzards in Snowdonia, 1977-2007. *Welsh Birds* 6: 38-48.

Moore J. 2005. Aggressive Buzzard in Ceredigion. *Welsh Birds* 4: 268.

Pritchard, R. 2020 Long-term aggression towards humans in a Buzzard. *Birds in Wales* 17: 68.

Pritchard, R. Hughes, J., Spence, I.M., Haycock, B. and Brenchley, A. 2021. *The Birds of Wales.* Liverpool University Press.

Prytherch, R. 2016. Buzzard nests, nest trees and prey remains in Avon. *British Birds*: 256-264.

Walls, S. and Kenward, R.E. 2020. *The Common Buzzard.* Poyser. London.

Williams, G. A. and Coan, D. 1973. Buzzard attacking observers at nest. *British Birds* 66: 31-32.

Photo competition - highly commended
A crown of Kingfishers: Karen Burns

The population status of the Willow Tit in Ceredigion

Ian Morris
ianmaesyfelin@gmail.com

Crynodeb
Cynhaliwyd arolwg dros gyfnod o ddwy flynedd er mwyn cael amcangyfrif o boblogaeth Titw'r Helyg *Poecile montanus* yng Ngheredigion. Rodd yr arolwg trwy gydol y flwyddyn, er mwyn cael y nifer fwyaf o gyfleoedd ar gyfer gwaith maes. Cafwyd hyd i Ditw'r Helyg mewn 110 safle mewn 59 tetrad, ond roedd y rhan fwyaf o'r rhain mewn ardal gymharol fechan o fewn y sir. Ymddengys fod lleihad mewn dosbarthiad, os nad niferoedd, yn bosibilrwydd yn y dyfodol agos. Ar hyn o bryd, amcangyfrifir fod y boblogaeth rhwng 100 a 150 o diriogaethau. Cynhelir arolwg cenedlaethol i gael diweddariad ar yr amcangyfrif o faint poblogaeth y D.U., ond mae data diweddar yn awgrymu ei fod yn 2,750 pâr. Amcangyfrifwyd fod poblogaeth Cymru yn 2,300 aderyn yn 2002; gyda'r rhai sydd yng Ngheredigion yn rhan sylweddol o'r boblogaeth yma.

Abstract
A survey was carried out over two years in order to estimate the population of the Willow Tit *Poecile montanus* in Ceredigion. The survey was undertaken throughout the year in order to maximise the opportunities for doing field work. Willow Tits were found at 110 sites in 59 tetrads but most of these were confined to a relatively small area within the county. A reduction in range, if not numbers, seems a distinct possibility in the near future. The population is currently estimated to be between 100-150 territories. A national survey is being undertaken to provide an update on the estimated size of the UK population, though recent data suggested this to be 2,750 pairs. The Welsh population was estimated to comprise 2,300 birds in 2002; those that occur in Ceredigion form a substantial part of that population.

Introduction
The Willow Tit has undergone a 93% decline in numbers between 1970-2015 (Hayhow *et al*. 2018). As such, it is red listed as a species of conservation concern and is a priority species on the UK biodiversity action plan. The causes of this terrible decline are not fully understood but could include competition from Blue *Cyanistes caeruleus* and Great *Parus major* Tits, predation by Grey Squirrels *Sciurus carolinensis*, Jay *Garrulus glandarius* and Great Spotted Woodpeckers *Dendrocorpos major* as well as habitat loss because of clearance and drainage and deterioration due to drying out (Lewis *et al*. 2009). However, Siriwardena (2004) found that population trends were stable in their preferred wet habitats.

The species is largely confined to the part of Ceredigion north of a line from Lampeter to Aberaeron (Roderick, 2010). Looking back through copies of the county bird reports to 1988, there has been a gradual increase in the number of records submitted. Initially, there were no records at all, but a greater recognition of the population decline has prompted an increase in submissions and now about a dozen records tend to be published each year. Nearly all of these have been north of Aberaeron and Lampeter, suggesting that Roderick's statement may be correct.

The Bird Atlas 2007-11 (Balmer *et al*. 2013) reveals that Willow Tits were found in 12 hectads (10x10km squares) in Ceredigion during the survey work, seven being roughly to the north of this

line and five to the south. Furthermore, the relative breeding abundance map in the atlas suggests that Ceredigion is one of the best areas in the UK to still find this species with a reasonably high breeding density in the county.

My own interest in Willow Tits arose partly as a result of a long-term study I have been doing near to where I live (Morris 2017) and more recently due to my participation in the national survey of this species (National Willow Tit Survey, RSPB; **https://national-willow-tit-survey-rspb.hub.arcgis.com/**). Whilst taking part in this survey, use of a playback device revealed there to be approximately twice as many birds in my own study area than I had previously estimated. Furthermore, I was able to locate these birds far more rapidly than was previously the case, when several visits were required. Towards the end of the breeding season in 2019 I employed the device at Cross Inn Forest and Bethania where there have been only occasional records over the years and found an estimated 12 territories. I decided to widen the scope of my surveying to embrace all of those areas of Ceredigion where the species was found during the last national atlas work.

Methods

1:25,000 scale ordnance survey maps were used to locate possible areas of suitable habitat to be surveyed. Willow Tits are usually found in habitat marked on the map as bracken, heath or rough grassland, or else as marsh or reeds. However, for these areas to be suitable they must have become neglected and be subject to woodland encroachment by birch *Betula* spp., Alder *Alnus glutinosa* and especially willow *Salix* spp., (Lewis *et al*., 2009). Occasionally, coniferous plantations on boggy sites are occupied but only in the earlier stages of succession when a mix of conifers and deciduous trees are often together. Additionally, they may be found in mature plantations but only where ribbons of suitable habitat follow streams within the forest. The search could be refined once I was in the field and additional sites were often found this way.

Playback was employed as instructed in the national survey. The device was used for two minutes and then I waited for two minutes for a response. Each use of playback was done at least 200m apart and no more than 100m from the nearest suitable habitat. I occasionally visited sites twice if I felt that I may have missed birds on my initial visit. The survey was carried out between February 2019 and April 2021. Though every effort was made to survey as many sites as possible between mid-February and mid-April when birds are most vocal, this would have restricted my personal surveying opportunities considerably. Therefore, I have recorded my results as territories rather than breeding pairs since a considerable number were found at other times of the year.

Results

Willow Tits were found in 11 hectads in this survey compared with 12 in the national atlas (Fig.1.). A total of 110 territories were identified across 59 tetrads (Table 1). The core distribution clearly lies north-east of Lampeter with the bulk of the territories found in just four of these hectads, an area bounded roughly by the villages of Bronant in the north and Llangybi in the south, with Cross Inn Forest to the west and Cors Caron NNR to the east. Beyond the core range it is possible that birds have been overlooked but a request for such information on social media and the local BTO newsletter failed to get a single response, suggesting that birds there are scarce.

Additionally, 25 sites were identified that looked suitable for this species but where no birds were recorded. Sometimes, unsuccessful visits were made to them but elsewhere these locations were simply inaccessible for various reasons.

Hectad	Number of occupied tetrads (maximum 25)	Number of territories	Number of other possible sites with Willow Tits	Present in last national atlas *
SN34	0	0	0	*
SN35	2	4	0	*
SN44	1	1	0	
SN45	1	1	0	*
SN54	1	1	3	*
SN55	3	3	2	*
SN56	11	25	8	*
SN64	1	1	1	*
SN65	14	27	4	*
SN66	16	31	7	*
SN67	0	0	0	*
SN76	7	14	0	*
SN77	2	2	0	*
Totals	**59**	**110**	**25**	

Table 1. Sites occupied – and with the potential to be occupied - by Willow Tits in Ceredigion.

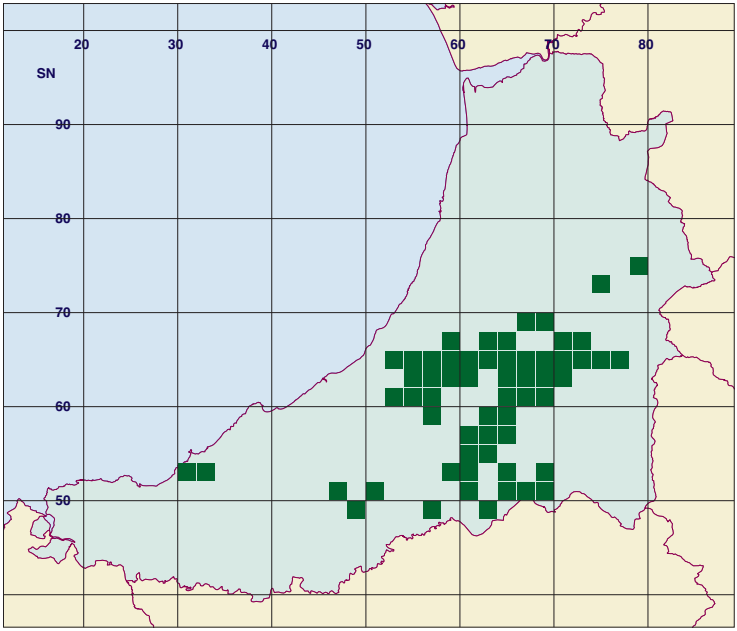


Figure 1. Ceredigion with the locations of tetrads occupied by Willow Tits.

Figure 2. The old railway line at Cors Caron NNR. 18 Willow Tit territories were found to be closely associated with the route of the railway between the villages of Llangybi and Tynygraig, a distance of 23km.

Discussion

The impression gained is of a species existing in small oases of suitable habitat, even in those areas where they are most abundant. Though on occasions, most notably at Cors Caron (Fig.2), Willow Tits were found just a few hundred metres apart, they were frequently separated by a kilometre or more. For example, a cluster of four territories near Plwmp in the south west were at least 10km from the other nearest sightings. Likewise, the two sightings in the north-east (SN77) may be several kilometres from other Willow Tits. It seems reasonable to suggest that across much of their range in Ceredigion, Willow Tits are isolated and very low in numbers, and therefore vulnerable to local extinctions.

An ongoing study at Lake Vyrnwy by Mike Haigh found that the period July to October is when juveniles disperse, with young birds prone to wander more widely in search of a territory and a mate, possibly as much as 10km in extreme circumstances (Mike Haigh, pers. comm.). This could have resulted in me double counting some birds. Also, this is the period prior to the onset of significant winter mortality. Therefore, birds found at this time of year could have slightly exaggerated the numbers somewhat. On the other hand, it is inevitable that I have overlooked birds and this number is unknown. Additionally, 25 other suitable looking sites were noted. I estimate that there could be between 100-150 Willow Tit territories in Ceredigion, and that this estimate is probably a reasonable guide to the breeding population, due to their sedentary nature.

The national Willow Tit survey being undertaken will provide an accurate update on the UK population, which was previously estimated at 2,750 pairs in 2016, an estimate that was considered

to be moderately reliable. The population of Willow Tits in Ceredigion may therefore represent as much as 5% of the estimated UK population.

The second national atlas (Gibbons *et al*. 1993) showed Willow Tits to be present along the Dyfi estuary, albeit at lower abundance than elsewhere in the county. They were absent there in the third atlas. I am not aware of any subsequent records from that area and I searched suitable looking habitat at Cors Fochno NNR without success. Existing, as most Willow Tits now appear to, in the centre of Ceredigion on land that appears not to be under too much pressure from agricultural improvement or other development, it is to be hoped that numbers are holding steady. However, the few pairs that hold on in the more intensively farmed south west of the county are surely threatened and a further reduction in range in these places must be a strong possibility.

Acknowledgements

I thank the Editor for his assistance. Mike Haigh shared information about his study at Lake Vyrnwy and Simon Wotton for his encouragement; Iestyn Evans, Reserve Manager at Cors Caron NNR who allowed access to the site; and Ian Spence for the map, using DMAP by Dr A.J. Morton. I also thank landowners who allowed me access to their boggy fields and woodlands.

References

Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. and Fuller, R.J. 2013. *Bird Atlas 2007-11: The breeding and wintering birds of Britai and Ireland*. Thetford, BTO Books.

Gibbons, D.W., Reid, J. and Chapman, R. 1993. *The New Atlas of Breeding Birds in Britain and Ireland:1988-1991*. London, T.&A.D. Poyser.

Hayhow, D.B., Ausden, M.A., Bradbury, R.B., Burnell, B., Copeland, A.I., Crick, H.Q.P., Eaton, M.A., Frost, T., Grice, P.V., Hall, C., Harris, S.J., Morecroft, M.D., Noble, D.G., Pearce-Higgins, J.W., Watts, O. and Williams, J.M. 2018. *The State of the UK's birds 2017*. RSPB BTO WWT DAERA JNCC NE NRW. Sandy, Beds.

Lewis, A.J.G., Amar, A., Charman, E.C. and Stewart, F.R.P. 2009. The decline of the Willow Tit in Britain. *British Birds* 102: 386-393.

Morris, I.J. 2017. Marsh Tits and Willow Tits in 10km square SN65 in Ceredigion. *Birds in Wales* 14:1 35-40.

Roderick, H., Davis, P. 2010. *Birds of Ceredigion*. The Wildlife Trust, South and West Wales.

Siriwardena, G.M. 2004. Possible roles of habitat, competition and avian nest predation in the decline of the Willow Tit in Britain. *Bird Study* 51:193-202.

Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D. and Noble, D. 2020. Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 113:69-104.

Llysdinam's contribution to ornithology in Mid-Wales

Fred Slater
slaterfm@cf.ac.uk

Crynodeb
Saif Ystâd Llysdinam, sy'n eiddo teulu Dillwyn Venables Llewelyn, gyferbyn â phentref Pontnewydd ar Wy yng nghanolbarth Powys, gydag Afon Gwy rhyngddynt. Yn y 1900au cynnar, gosododd Syr Charles Dillwyn Llewellyn un o'r blychau nythu oedd yn cael eu monitro cyntaf yng Nghymru ar yr ystâd. Parhawyd y monitro gan ei fab, Syr Michael. Pan roddodd Syr Michael wahoddiad i'r hyn sy'n awr yn Brifysgol Caerdydd i agor Canolfan Faes yn Llysdinam, roedd wedi sefydlu cyfleuster a barhaodd archwiliadau adaryddol oedd eisoes mewn bod a datblygu rhai newydd, rhywbeth a ddaliodd ymlaen, mewn rhan, hyd yn oed wedi i Ganolfan Faes Llysdinam gau yn 2010. Mae'r adroddiad yna yn rhoi blas ar y rhychwant o destunau adaryddol a archwiliwyd yn ardal afonydd a choedwigoedd canolbarth Cymru dros yr hanner can mlynedd ddiwethaf, y bu gan Ganolfan Faes Llysdinam ran ynddynt.

Abstract
The Llysdinam Estate of the Dillwyn Venables Llewelyn family lies opposite the village of Newbridge-on-Wye in mid Powys, separated from it by the River Wye. In the early 1900s Sir Charles Dillwyn Llewellyn set up, on the estate, one of the earliest monitored nest box sites in Wales. Monitoring continued through his son Sir Michael. When Sir Michael invited what is now Cardiff University to open a Field Centre at Llysdinam he had established a facility that took over existing, and developed new, ornithological investigations which have continued, in part, even after the Llysdinam Field Centre closed in 2010. This report gives a flavour of the range of ornithological topics which have been undertaken in the mid-Wales rivers and woodlands over the last half century involving the Llysdinam Field Centre.

Introduction
Set on the Breconshire bank of the River Wye in mid-Wales is the Llysdinam Estate of the Dillwyn Venables Llewellyn family. The family has a historic interest in science and nature, originally centred around the Dillwyn Llewelyn side of the family and their home at Penllergaer near Swansea. Sir Charles Dillwyn Llewellyn came to Llysdinam on his marriage to Katherine Minna Venables in 1893 and by Royal Licence became a Dillwyn Venables Llewelyn. In approximately 1909 he reported that he erected "a few nest boxes in my garden" which, in the first year, attracted "a few tits, Redstarts and Robins" along with "one nest of Pied Flycatcher". More boxes were added and proportionately more Pied Flycatchers *Ficedula hypoleuca* nested in them with "the effect of driving away the Redstarts and Robins which have now almost ceased to use the boxes". The design of these original boxes is not given but the presence of Robins *Erithacus rubecula* suggests they were of a somewhat open construction. This was probably one of first systematically-recorded series of bird boxes in the United Kingdom and, with breaks around the First and Second World Wars, monitoring has continued up to the present time. Unfortunately, many of the historic records, stored in a property in the village during the Second World War, were destroyed it was said, by itinerants illegally using the cottage and used its store of documents as fuel for the fire.

At this time, the Pied Flycatcher seems to have been considered a predominantly riverside bird, as

Sir Charles noted "The Pied Flycatcher had previously nested in fair numbers in trees along the riverbank and still continues to do so". Bingham quoted by Swainson (1893) reported it "not uncommon along the rivers Elan and Claerwen", their waters entering the Wye some kilometres upstream of Llysdinam. Swainson (1893) also noted that Pied Flycatchers were principally associated with the Usk and its tributaries in south Breconshire. Indeed, Vaughan (1919) noted "on April 16 1919 while fishing on the Usk just below Brecon I saw a cock Pied Flycatcher in very fine plumage flying about and feeding by some willows on the bank of the river" and commented on its rarity. A century ago, the Wye at Llysdinam was lined by mature trees, presumably with plenty of nesting opportunities for small passerines. Today there are riverside trees, but few of great age. Nevertheless, nest boxes on these riverside trees are often occupied by early Pied Flycatcher arrivals. However, the concept of them being riverside birds may relate more to the fact that most early records come from the salmon *Salmo* spp. fishing gentry on aristocratic estates, who rarely found sporting or other reason to venture to the hillside Sessile Oak *Quercus petraea* woodlands where these birds are, and no doubt were, well established (see Campbell 1954).

Although not intended as ornithological records, the Llysdinam Game Books (Slater 1995) give a brief glimpse between 1911 and 1939 into upland birds, particularly on the estate uplands around Drum Ddu northwest of Llysdinam and on their holdings on the Mynydd Epynt south of Builth Wells. In both areas Red Grouse *Lagopus lagopus*, Black Grouse *Lyrurus tetrix*, Grey Partridges *Perdix perdix*, Pheasants *Phasianus colchicus* and Corncrake *Crex crex* were recorded in the game books. In August/September 1911 at Upper Chapel on the Mynydd Epynt 37 grouse, five blackgame and four corncrakes were shot. Partridges seemed widespread, appearing in the game bags of the mid-1930s from Llandewi in north Radnorshire, to Pencerrig and Garth near Builth, Wyecliff near Hay on to Penllegaer near Swansea. Red grouse records between 1933 and 1935 come from Mynydd Epynt sites, as well as Maesllwch, Painscastle. In September 1936 34 grouse and one blackgame were shot on the Llysdinam uplands towards Drum Ddu. Blackgame occurred in small numbers and intermittently at Upper Chapel throughout the period 1924 to 1939. Not in the game books, but from verbal records of farmers, who in the pre-second world war period reported Corncrake in fields around Llysdinam and a stuffed specimen hit by a train near Howey from about the same period adorned the mantlepiece of a retired local railway worker.

In 1924 Sir Charles erected 36 new boxes "of various types" at Llysdinam, all with 28.5mm holes and moveable lids. They were erected between *c*.91cm and *c*.137c) off the ground. This compares well to our subsequent boxes which, except for experimental boxes, had 28-30mm holes (about optimum according to Lundberg and Alatalo 1992) and were erected at a height of 140cm. Occupancy and breeding success rose until, in 1931 16 nests produced 82 young, a rate of success in this woodland which has not since been exceeded due, probably, to the current height of the canopy at about 35m with peripheral Wellingtonias *Sequoiadendron giganteum* up to 43m and considerable ornamental understorey. Today, most of our nest boxes are in oak *Quercus* spp.dominated woodlands but 20 of these 36 boxes which retained their original position from 1926-33 were on diverse species with half on pine *Pinus* spp. or spruce *Picea* spp. and the others equally spread between oak, Sweet Chestnut *Castanea sativa*, Wych Elm *Ulmus glabra*, Ash *Fraxinus excelsior* and Beech *Fagus sylvatica* with little apparent difference in Pied Flycatcher nest box occupancy between the tree species. During this period there were 82 Pied Flycatcher, 20 Blue Tit *Cyanistes caeruleus*, six Great Tit *Parus major*, four Coal Tit *Periparus ater* (all on ash) and three Nuthatch *Sitta europaea* nests, giving a 72% occupancy rate.

In 1932 Sir Charles submitted a note to British Birds on Pied Flycatchers laying abnormal eggs in two seasons. This was updated in his 1934 paper; what he presumed to be the same bird laid similarly

very small infertile eggs in a box in the same vicinity of the woodland as used in the previous two years. From this he concluded that (without the benefit of ringing) birds did return to the same woodland over several years. Such eggs are occasionally found in our area and were the subject of a paper Slater and Jennings (1987) and, most recently, small eggs were found in one of our nest boxes in 2020.

The arrival of Cardiff University at the Llysdinam Field Centre

After the Second World War, the Venables Llewelyn family returned to Llysdinam in the early 1950s. Sir Charles' son, Sir Michael Venables Llewelyn, who also had an interest in natural history and was a founder of the Herefordshire and Radnorshire Nature Trust (now Radnorshire Wildlife Trust), took on the mantle of the Llysdinam nest boxes. In 1970, the University of Wales Institute of Science and Technology (UWIST) acquired a Field Centre at Llysdinam and appointed me as its first Director in 1974, where I remained until retirement in 2010, the site having passed through various iterations of university ownership finally being part of Cardiff University's School of Biosciences. In the early 1960s Chris Mead added Llysdinam and some other nearby sites to his annual June tours of mid-Wales nest boxes, first weekend for tits, second for Pied Flycatchers. In the mid-1970s I joined him on these ringing pilgrimages to boxed woodlands from Hereford to the Tywi Valley where Tim Stowe (Stowe 1987) was studying the management of Sessile Oakwoods for Pied Flycatchers. Being a good ambassador for ringing, Chris encouraged me to train for my ringing licence, and, once qualified, encouraged me to establish the Field Centre's own nest-boxed woodlands. A thousand or so boxes later, many made by Maurice Slater, my uncle, and erected in some thirty sites, mainly in and around mid-Wales, plus a few in Shropshire, have led to many short- and long-term studies. For example, while Lundberg and Alatalo (1992) had earlier commented on the importance of nest box height, and although for convenience, rather than any other factor, Llysdinam boxes were erected at more or less 1.5m off the ground, we conducted an experiment using 30 boxes on ten deciduous trees at 1.5m, 3.0m and 4.5m above the ground. Five boxes were used; three by Pied Flycatchers and one each by Great Tit and Blue Tit. All five of these were in the 4.5m high boxes. The experiment was repeated in a Western Hemlock *Tsuga heterophylla* plantation with boxes at 1.5 and 4.5m on ten trees. Only three boxes were used, one each by Pied Flycatcher, Coal Tit and Wren *Troglodytes troglodytes* and all at 4.5m.

Before it was regarded as a health hazard, all our boxes prior to 1990 were dipped in creosote as a preservative. To investigate if treatment affected box selection, 20 freshly creosote dipped and 20 undipped boxes were erected alternately on a grid in a 20-year-old Norway Spruce *Picea abies* plantation. Occupancy was expected to be low and only six were used, all creosoted and all used by Coal Tits and Blue tits. 24 creosoted and 24 undipped boxes were similarly arranged in a nearby Pedunculate Oak *Quercus robur* woodland. Seven creosoted boxes were used (Pied Flycatcher, Blue Tit, Great Tit, Tree Sparrow *Passer montanus*) and eleven untreated boxes occupied by Pied Flycatchers and Blue Tits. We continued to use treated boxes dipped in autumn giving them at least six months before occupancy (Slater 1998). On one occasion, in late April, we found a couple of new boxes which had not been erected and, without much hope of occupancy, dipped them in creosote early one morning, erected them (still wet) an hour or so later, and by the following morning there was nesting material in one box which went on to produce a full brood of Pied Flycatchers.

Bird studies take off

Our early work centred on using the boxes in a non-specific way, measuring things such as nest temperature fluctuations, and food removal rates from feeders (Slater 1979, 1993, 1998a) as well as autumn use of nest boxes by moths (Morgan and Slater 1984) and a brief glance at species such as Golden Oriole (Slater 2000). Jo Robertson became the first PhD student at the Centre to use our nest

boxes for her studies on the influence of supplementary feeding on the condition and breeding success of titmice (Robertson 1998). Dr Roberton also produced interesting work on seasonal movements of Blue and Great Tits (Robertson and Slater 1997). Long-term data from the boxes were also used to describe first-egg-date fluctuations and migration returns (Slater 1998b, 1999a, 1999b). Over some 14 successive summers Professor Mike Kern came from the University of Wooster, Ohio, to study Pied Flycatchers in several of our local woodlands, exploring a range of ecological and biological aspects including nest humidity, water loss in eggs and the significance of egg volume (Kern, Cowie and Yeager 1992, Kern and Cowie 1995, Kern and Cowie 1996, Kern and Cowie 2000b), experimental changes in clutch size (Kern, Cowie and Slater 2000a), ptilochronology (Kern and Cowie 2002), blood metabolism (Kern *et al*. 2001, 2005, 2007) and return rates and dispersal distance of ringed Pied Flycatchers. On a metabolic theme, Nicola Goodship, under the supervision of Dr Katherine Buchanan, studied for her PhD on the relationship between nestling begging and testosterone in Pied Flycatchers, using our boxes for her study (Goodship 2006, Goodship and Buchanan 2006, 2007). More recently, Tyrrell (2017) has undertaken a pilot study into aspects of the diet of Pied Flycatchers using, in part, data from our woodlands. The Llysdinam work on Pied Flycatchers has, therefore, become more widely known and our data have contributed to Europe-wide studies into climate change and laying date (Both *et al*. 2004), yolk carotenoids (Eeva *et al*. 2010), variation in egg mass (Ruuskanen 2011), and parasite transfer in Pied Flycatchers (Jones *et al*. 2018).

Llysdinam's connection to birds has not, however, been all about Pied Flycatchers, however. Professor Steve Ormerod, Professor of Ecology at Cardiff University, studied for his PhD at Llysdinam and, as he says in his University profile: "I came to Cardiff in 1980 for the prestigious UWIST MSc in Applied Hydrobiology, from there completing a PhD on water quality and invertebrates in the Wye river-system. Simultaneously, I developed an interest in the ecology of river birds, showing for the first time how this group was affected by acid rain. These major themes of multiple global-scale pressures on freshwater ecosystems, river invertebrates and birds in aquatic habitats, have continued to provide my major research models". His interest in river birds particularly involved Dippers *Cinclus cinclus*, often centring on the mid-Wye, and produced numerous publications, often with his collaborator Dr Steph Tyler (e.g. Ormerod *et al.* 1985; Ormerod and Tyler 1990; Tyler and Ormerod 1994). Steve brought Professor John O'Halloran, currently Professor of Zoology and interim President (previously Vice President) of University College, Cork, to the Centre to work on Dippers (O'Halloran *et al*. 1990). While at Llysdinam, John's interests also extended to swans *Cygnus* spp. in the Wye valley (Slater *et al*. 1990, 1992) where he collaborated with Dr John Foster. Steve also brought to the Centre to study Dippers, Dr Sonja Yoerg, then a Lecturer at the University of California, Berkeley, who looked mainly at foraging behaviour from fledging to dispersal (Yoerg 1990, 1994, 1998; Yoerg and O'Halloran 1991). Dr Richard Jenkins also began his research career at Llysdinam studying Water Rail *Rallus aquaticus* under the supervision of Steve Ormerod (Jenkins *et al*. 1995) and is now UK Manager of the Global Species Programme of IUCN in Cambridge.

More recent times

In the decade before the Field Centre's closure in 2010, the fickleness of funding took Llysdinam into research into biomass crops such as short rotation willow *Salix* spp. coppice and Elephant Grass *Miscanthus* sp.. Dr Tsehaye Semere worked on biomass grass crops on the Herefordshire-Powys border (Semere and Slater 2007), producing several well-quoted research papers, including his observations on birds in biomass crops. Dr Danielle Fry took for the title of her PhD thesis "Biodiversity of short rotation willow coppice in Wales: with particular reference to birds" (Fry 2008, 2011). Her studies also allowed her to compare her work in Wales to willow coppice in New Zealand (Fry and Slater 2008). The final PhD student to study birds in biomass crops, in this case biomass

grasses, was Dr Jennifer Clapham who looked at the abundance and diversity of small mammals and birds in mature crops of perennial rhizomatous biomass grasses (Clapham 2011, Clapham *et al*. 2008). Even after the closing of the Field Centre, Cardiff University PhD student Jez Smith used our boxes at Ty Mawr as an important part of his studies into the impact of climate change on woodland birds.

Since the closure of the Field Centre, nest boxes at four sites have continued to be monitored and pulli ringed. Sir Charles' original Llysdinam woodland sites, Ty Mawr Llanwrthwl and Coed y Cilau, are therefore still contributing data with the aim of updating the Slater (1999) paper on first egg-dates using some of the statistical methodology used by Reese and Tucker (2019).

A lot of water has passed under the Wye bridge in Newbridge since the Venables Llewelyns first took an interest in the birds of the area. Some of the original woodlands have now outgrown Pied Flycatchers, being too tall with too much understory. But without that start our knowledge of the avian fauna of mid-Wales and further afield may never have developed in the way that it has. The Llysdinam Field Centre may be no more but its contribution to Wales' ornithology will live on in the literature and the alumni it has nurtured.

References

Both, C.,Artemyev, A.A., Blaauw, B., Cowie, R.J., Dekhuijzen, A.J., Eeva, T., Enemar, A., Gustafsson, L., Ivankina, E.v., Jarvinen, A., Metcalfe, N.B., Nyholme, N.E.I., Potti, J., Ravussin, P-A., Sanz, J.J., Silverin, B., Slater, F.M., Sokolov, L.V., Torok, J., Winkel, W., Wright, J.,Zang, H. and Visser, M.E. 2004. Large-scale geographical variation confirms that climate change causes birds to lay earlier. *Proceedings of the Royal Society of London B: Biological Sciences* 271: 1657-1662.

Campbell, B. 1954. The breeding distribution and habitats of the Pied Flycatcher (*Muscicapa hypoleuca*) in Britain. *Bird Study* 1: 81-101.

Clapham, S. J., Slater, F. M. and Booth, E. 2008. The biodiversity of established biomass grass crops. *Aspects of Applied Biology* 90: 325-329.

Clapham, S. J. 2011. *The abundance and diversity of small mammals and birds in mature crops of the perennial grasses* Miscanthus x giganteus *and* Phalaris arundinacea *grown for biomass energy.* PhD thesis, Cardiff University.

Eeva, T., Ruuskanan, S., Salminen, J-P., Belskii, E., Järvinen, A., Kerimov, A., Korpimäki, E., Krams, I., Moreno, J., Morosinotto, C., MäR., Orell, M., Qvarnström, A., Siitari, H., Slater, F.M., Tilgar, V., Visser, M.E., Winkel, W., Zang, H. and Laakksonen, T. 2010. Geographical trends in the yolk carotenoid composition of the pied flycatcher (*Ficedula hypoleuca*). *Oecologia*. 165: 277-287.

Fry, D. and Slater, F. 2008. Birds of New Zealand willow coppice. *Ringers' Bulletin*, Summer 2008: p13.

Fry, D. A. 2008. *Biodiversity of short rotation willow coppice in Wales, with particular reference to birds*. PhD thesis, Cardiff University.

Fry, D.A. and Slater, F.M., 2011. Early rotation short rotation willow coppice as a winter food resource for birds. *Biomass and Bioenergy* 35: 2545-2553.

Goodship, N. M. 2006. *Endocrine control of nestling begging behaviour in the pied flycatcher,* Ficedula hypoleuca. PhD thesis, Cardiff University.

Goodship, N. M. and Buchanan, K. L. 2006. Nestling testosterone is associated with begging behaviour and fledging success in the pied flycatcher, Ficedula hypoleuca. *Proceedings of the Royal Society B: Biological Sciences* 273: 71-76.

Goodship, N.M. and Buchanan,K.L. 2007. Nestling testosterone controls begging behaviour in the

pied flycatcher *Ficedula hypoleuca*. *Hormones and Behaviour* 52: 454-460.

Jenkins, R.K.B., Buckton, S.T. and Ormerod S.J. 1995. Local movements and population density of Water Rails *Rallus aquaticus* in a small inland reedbed. *Bird Study* 42: 82-87.

Jones, W., Kulma, K., Bensch, M., Cichon, M., Kerimov, A., Krist, M., Laaksonen, T., Moreno, J., Munclinger, P., Slater, F.M., Szollosi, E., Visser, M.E. and Qvarnstrom, A. 2018. Interspecific transfer of parasites following a range-shift in *Ficedula* flycatchers. *Ecology and Evolution* 8: 12183-12192.

Kern, M. D., Cowie, R. J., and Yeager, M. 1992. Water loss, conductance, and structure of eggs of pied flycatchers during egg laying and incubation. *Physiological Zoology* 65: 1162-1187.

Kern, M. D. and Cowie, R. J. 1995. Humidity levels in Pied Flycatcher nests measured using capsule hygrometers. *The Auk* 112: 564-570.

Kern, M. D. and Cowie, R. J. 1996. The Size and Shape of Eggs from a Welsh Population of Pied Flycatchers: Testing Hoyt's Use of Egg Dimensions to Ascertain Egg Volume. *Journal of Field Ornithology* 67: 72-81.

Kern, M., Cowie, R.J. and Slater, F.M. 2000a. Responses of egg-laying pied flycatchers to experimental changes in clutch size: a re-examination. *The Condor* 102: 428-432.

Kern, M. D. and Cowie, R. J. 2000b. Female pied flycatchers fail to respond to variations in nest humidity. *Comparative Biochemistry and Physiology Part A: Molecular and Integrative Physiology* 127: 113-119.

Kern, M., Bacon, W., Long, D. and Cowie, R. J. 2001. Possible roles for corticosterone and critical size in the fledging of nestling pied flycatchers. *Physiological and Biochemical Zoology* 74: 651-659.

Kern, M. D. and Cowie, R. J. 2002. Ptilochronology proves unreliable in studies of nestling Pied Flycatchers. *Ibis* 144: 23-29.

Kern, M., Bacon, W., Long, D. and Cowie, R. J. 2005. Blood metabolite and corticosterone levels in breeding adult pied flycatchers. *The Condor* 107: 665-677.

Kern, M. D., Bacon, W., Long, D. and Cowie, R. J. 2007. Blood metabolite levels in normal and handicapped pied flycatchers rearing broods of different sizes. *Comparative Biochemistry and Physiology Part A: Molecular and Integrative Physiology* 147: 70-76.

Kern, M., Slater, F. and Cowie, R. 2014. Return rates and dispersal distances of Welsh Pied Flycatchers *Ficedula hypoleuca* and factors that influence them. *Ringing & Migration* 29: 1-9.

Lundberg, A and Alatalo, R. 1992. *The Pied Flycatcher.* London, T.&A.D. Poyser.

Morgan, M.J. and Slater, F.M. 1984. Unexpected nest-box occupants. *Nature in Wales, New Series* 2: 110-111.

O'Halloran, J., Gribbin, S.D., Tyler, S.J. and Ormerod S.J. 1990. The ecology of dippers *Cinclus cinclu*s (L.) in relation to stream acidity in upland Wales: time-activity budgets and energy expenditure. *Oecologia* 85: 271-280.

Ormerod, S.J., Tyler, S.J. and Lewis J.M.S. 1985. Is the breeding distribution of Dippers influenced by stream acidity? *Bird Study* 32: 32-39.

Ormerod, S.J. and Tyler, S.J. 1990. Population characteristics of Dipper (*Cinclus cinclus*) roosts in mid and south Wales. *Bird Study* 37: 165-170.

Reese, R.A. and Tucker, J.J. 2019). Descriptive models for first arrival dates of migrants in an inland UK county. *Ringing & Migration* 29: 1-9.

Robertson, J.C. and Slater, F.M. 1997. Seasonal movements of Blue Tits *Parus caeruleus* and Great

Tits *P. major* in mid-Wales. *Welsh Birds* 1: 38-40.

Robertson, J. C. 1998. *The influence of supplementary feeding on the condition and breeding success of titmice* (Paridae). PhD thesis, University of Wales.

Ruuskanen, S., Siitari, H., Eeva, T., Belskii, E., Järvinen, A., Kerimov, A., Krams, I., Moreno, J., Morosinotto, C., Mänd, R., Möstl, E., Orell, M., Qvarnström, A., Salminen, J-P., Slater, F., Tilgar, V.,Vissser, M. E., Winkel, W., Zang, H. and Laaksonen, T. 2011. Geographical variation in egg mass and egg content in a passerine bird. *PLoS ONE* 6: p.e25360.

Semere, T. and Slater, F.M. 2007. Ground flora, small mammals and bird species diversity in miscanthus (*Miscanthus x giganteus*) and reed canary-grass (*Phalaris arundinacea*) fields. *Biomass and Bioenergy* 31: 20-29.

Slater, F.M. 1979. Temperature changes as a measure of Nestbox activity in the Pied Flycatcher. *Breconshire Birds* 4: pp 23-25.

Slater, F.M. 1993. Food removal rate from feeders as a measure of bird activity in rural woodland fringe. *Welsh Bird Report* 6: 73-76.

Slater, F.M. 1994. A Squirrel resistant peanut feeder. *Ringer's Bulletin* 8: 79.

Slater, F.M. 1995. Extracts from the Llysdinam Game Books. *Welsh Birds* 1: 21-24.

Slater, F. M. 1998a. Nestbox use in relation to height and wood treatment. *Ringers' Bulletin* 4: 74.

Slater, F.M. 1998b. Three quarters of a century of Pied Flycatchers *Ficedula hypoleuca* in Mid Wales. *Welsh Birds* 2: 16-20.

Slater, F.M. 1999a. Pied Flycatcher *Ficedula hypoleuca* migration from some woodlands in the upper Wye Valley. *Welsh Birds* 2: 109-112.

Slater, F.M. 1999b. First-egg date fluctuations for the Pied Flycatcher *Ficedula hypoleuca* in the woodlands of mid-Wales in the twentieth century. *Ibis* 141: 489-506.

Slater, F.M. 2000. Golden Orioles in Radnorshire. *Welsh Birds* 2: 227.

Slater, F.M., Foster, J. and O'Halloran, J. 1990. Mute, Bewick's and Whooper Swans in mid Wales and the Lower Wye Valley. *Radnorshire Society Transactions* LX: 12-26.

Slater, F.M., Foster, J. and O'Halloran, J. 1992. Population trends in Mute Swans (*Cygnus olor*) in mid-Wales and the Lower Wye Valley. *Welsh Bird Report* 4: 74-79.

Slater, F.M. and Jennings, P.P. 1987. Aberrant eggs of Pied Flycatcher *Ficedula hypoleuca* in mid-Wales. *Bird Study* 34: 185-186.

Smith, J.A., 2019. *Impacts of Climate Change on Woodland Birds; From Individual Behaviour to Population Change*. PhD thesis, Cardiff University.

Stowe, T.J. 1987. The Management of Sessile Oakwoods for Pied Flycatchers. In C. James Cadbury & Michael Everell (eds.) *RSPB Conservation Review* 1: 78-83.

Swainson E.A. 1893. Survey in "The Field". *Zoologist* Ser 3 17: 420-424.

Tyler, S.J. and Ormerod, S.J. 1994. *The Dippers*. London, T.&A.D. Poyser.

Tyrrell, C. 2017. Molecular analysis of the diet of Pied Flycatchers *(Ficedula hypoleuca*) in the context of climate change: productivity and carry-over effects: a pilot study. *Birds in Wales* 14: 20-34.

Venables Llewelyn, C. 1932. Pied Flycatcher laying abnormal eggs in two seasons. *British Birds* 26: 95.

Venables Llewelyn, C. 1934. On some breeding-habits of the Pied Flycatcher. *British Birds* 27: 251-255.

Vaughan, H.J. 1919. Pied Flycatcher in South Wales. *British Birds* 13: 27.

Yoerg, S.I. 1990. Infanticide in the Eurasian Dipper. *The Condor* 92: 775-776.

Yoerg, S.I. 1994. The development of foraging behaviour in the Eurasian dipper, *Cinclus cinclus,* from fledging until dispersal. *Animal Behaviour* 47: 577-588.

Yoerg, S.I. 1998. Foraging behavior predicts age at independence in juvenile Eurasian dippers (*Cinclus cinclus*). *Behavioral Ecology* 9: 471-477.

Yoerg, S.I. and O'Halloran, J. 1991. Dipper Nestlings fed by a Gray Wagtail. *The Auk* 108: 427-440.

Photo competition - highly commended
Little Egret on reflection: Don Cardy

Avocet *Recurvirostra avosetta* responses to predator activity at Newport Wetland Nature Reserve

Nicholas Bishop[1], Thomas Dalrymple[2], Jeremy A Smith[1], Richard Facey[2], Anthony Caravaggi[1],

[1] School of Applied Sciences, University of South Wales, 9 Graig Fach, Pontypridd, CF37 4BB
[2] Natural Resources Wales, c/o Redhouse Barns, Newport NP18 2AU
Corresponding author: anthony.caravaggi@southwales.ac.uk

Crynodeb

Deil Gwarchodfa Genedlaethol Gwlypdiroedd Casnewydd yr unig nythfa o'r Cambig *Recurvirostra avosetta* yng Nghymru. Er hynny, mae cynhyrchiant y nythfa yn gyson yn isel, oherwydd ysglyfaethu wyau a chywion gan adar a mamaliaid. Yma'r ydym yn disgrifio gweithgareddau'r ysglyfaethwyr, ymosodiadau torfol ac achosion o ysglyfaethu yn ystod tymor nythu 2019 gan ddefnyddio cyfuniad o samplo scan (adar ysglyfaethus a chydadweithiau) a thrapiau camera (mamaliaid ysglyfaethus). Y Frân Dyddyn *Corvus corone* a welwyd amlaf, gyda 151 (53%) o'r cyfanswm a welwyd, a'r unig rywogaeth oedd yn cymryd cywion Cambig yn uniongyrchol. Gwelwyd ymosodiadau ar Frain Tyddyn 52% o'r amser, yn aml gan Gambig unigol. Mewn cyferbyniad, gwelwyd chwe Bwncath *Buteo buteo*, ac ymosodwyd ar bob un gan amryw o Gambigod. Y Llygoden Ffrengig *Rattus norvegicus* oedd y mamal a welwyd yn ysglyfaethu amlaf, yn gyfrifol am 84% o'r cyfanswm. Roedd ymosodiadau torfol yn fwy cyffredin yn ystod cyfnodau o dymheredd is, efallai gan fod ysglyfaethwyr yn fwy prysur.

Abstract

The Newport Wetlands National Nature Reserve holds Wales' only breeding colony of Avocets *Recurvirostra avosetta*. However, colony productivity is consistently low due to predation of eggs and chicks by both avian and mammalian predators. Here we describe predator activity, mobbing activity and predation events during the 2019 breeding season using a combination of scan sampling (avian predators and interactions) and camera traps (mammalian predators). Carrion Crow *Corvus corone* was the most sighted avian predator with 151 (53%) of total sightings and the only species directly depredating Avocet chicks. Carrion Crows elicited a mobbing response 52% of the time, often by individual Avocets. In contrast, six Buzzards *Buteo buteo* were detected, all of which were mobbed by multiple Avocets. Brown Rat *Rattus norvegicus* was the most commonly detected mammal predator, accounting for 84% of total sightings. Mobbing activity was more common at lower temperatures, likely a result of increased predator activity.

Introduction

Avian populations are affected by a range of biotic and abiotic factors, including temperature and precipitation (Doyle *et al.* 2020), habitat (Kentie *et al*. 2018), anthropogenic impacts (e.g. Verga *et al*. 2017; Caravaggi *et al*. 2019a; da Silva *et al*. 2020) and predation (Roos *et al*. 2018). Many of these factors have particular relevance during the breeding season, when consistently high mortality among breeding adults, eggs or chicks can result in substantial and prolonged population declines (Grüebler *et a*l. 2008; Caravaggi *et al*. 2019b).

Wading birds (Order *Charadriiformes*; 'waders' hereafter) are commonly found along shorelines and mudflats where they forage for food, such as crustaceans and invertebrates. Many waders are ground-nesting species that occupy low-lying habitats such as wetland, mudflat saline lagoon and saltmarsh ecosystems for breeding and feeding (Smart *et al.* 2006). Such habitats are relatively rare due to destructive coastal processes and anthropogenic impacts (Klemas *et al*. 2004). As a result, ground-nesting wader colonies may be restricted to narrow strips or small patches of suitable habitat (e.g. Lavers and Haines Young 1996). Further, many waders are colonial breeders, a system that is thought to confer considerable benefits in terms of enhancing foraging efficiency (Beauchamp 1999), obtaining extra-pair copulations (Drachmann *et al*. 2002), and minimising individual depredation risk (e.g. Cresswell 1994; Hernández-Matías *et a*l. 2003; but see Varela *et al.* 2007). Certainly, such wader populations often exhibit considerable between-year variation in breeding success due to depredation by a range of species (Evans and Pienkowski 1984; Frederick and Collopy 1989).

The Avocet is a medium-sized (260-290g) wader with a distinctive, long, up-curved bill that is used to forage in waters heavy with sediment (Moreira 1995). It is widespread, with a patchy breeding distribution that includes northern Africa, central and eastern Asia, and Europe, including the UK where it is a species of conservation concern (Eaton *et al*. 2015). The breeding season in the UK extends between April and August. A typical clutch contains 3-4 eggs, incubation lasts for 23-25 days, and chicks fledge 35-42 days after hatching. Like many prey bird species, Avocets often respond to a perceived avian threat by performing a variety of diversionary displays or 'mobbing' potential predators. In contrast, responses to mammalian predators are comparatively weak, involving mostly aerial circling and terrestrial distraction displays (Sordahl 2004). Potential predators in the UK include the Red Fox *Vulpes vulpes*, Brown Rat (Seymour *et al*. 2003), Carrion Crow (MacDonald and Bolton 2008), Raven *Corvus corax* (Ewins *et al*. 1986), and Buzzard (Swann and Etheridge 1995).

The only breeding Avocet colony in Wales is located at Goldcliff Lagoons, a site that is part of Newport Wetlands National Nature Reserve (Dalrymple 2020). This population has experienced extremely low breeding success in recent years, with some years seeing up to 100% egg and chick mortality, despite active management. In this study we focus on the anti-predator behavior of the Goldcliff population, exploring associations with predator occurrence and weather that will increase our understanding of relevant community dynamics.

Methods

The study took place at Goldcliff lagoons, part of the Newport Wetlands NNR (OS ST 37183 82542); a site that was created in 1998 as compensation the for the destruction of the then Cardiff Bay SSSI. The reserve is owned and managed by Natural Resource Wales (NRW), with a visitor and education centre run by the Royal Society for the Protection of Birds (RSPB). A full description and history of the Newport Wetlands National Nature Reserve (NNR) is provided by Dalrymple (2020). Goldcliff lagoons are situated to the east of the NNR and comprises three saline lagoons, each of which contains a single islet, and is surrounded by fencing designed to exclude mammalian predators. Avocet breed on two of the islets along with Lapwing *Vanellus vanellus* and Redshank *Tringa totanus* (Fig. 1). Avian predators found in the wider landscape include Buzzard, Herring Gull *Larus argentatus*, Great Black-backed Gull *Larus marinus*, Raven and Carrion Crows, Grey Heron *Ardea cinerea* and Common Crane *Grus grus*; mammalian predators include Stoat *Mustela erminea*, Brown Rat, Red Fox, and Otter *Lutra lutra*.

The study took place between 23 March and 7 June 2019, i.e., during the Avocet breeding season. Avian predator activity was surveyed from a bird hide located in the south west of the lagoons (Fig.

1), by a single observer with binoculars (Bushnell H20 10x42 mm roof prism) and a telescope (Swarovski ATS/STS 80). Three surveys were conducted each week; one at the start of the week (Monday-Tuesday), one mid-week (Wednesday-Thursday) and one at the end of the week (Friday-Sunday), depending on the observer's availability (n=22). Environmental data, including temperature,

Figure 1. The positions of camera traps (■), the point of observation (▲) and breeding Avocet sub-colonies (hatched areas) at Goldcliff Lagoons.

wind direction and speed, precipitation (0-3, where 0 = none and 3 = heavy rainfall) and cloud cover on the okta scale (Smith *et al*. 2017) were recorded at the start of each survey period. Avian data were collected using a scan sampling method (Simpson and Simpson 1977) and by a single observer. Observations began at 08:30 and concluded at 10:30, during which time all avian predators observed, their interactions with Avocets (if any) and Avocet reactions (if any) were recorded. Mobbing was defined as two or more Avocets taking to the air to surround or attack potential threats. An assessment of the strength and consistency of the mobbing response was made, based on the number of Avocets involved, both at the start and end of the activity, and the duration of the mobbing activity. Herring Gulls, Lesser Black-backed Gulls and Great Black-backed Gulls were grouped for the purposes of this study ('gulls' from hereon), due to difficulties in discriminating between species at a distance or in sub-optimal conditions.

Four remote-sensing camera traps (Bushnell HD) were deployed at sluices around the reserve, inside the perimeter fence, to survey predatory mammal activity (Fig. 1). Vegetation height and density precluded the use of camera traps elsewhere on the site. Cameras had normal sensitivity and were set to capture still images, with a 30-second delay. Each camera trap was set 2m away from a *c*.20mm, wire mesh cage measuring approximately 30cm^2, at a height of 30cm and with a slight downward tilt. Cages were fixed in placed and baited with mackerel that was refreshed opportunistically by the reserve management team.

Scan sampling data were analysed using Pearson's *r* to explore temporal variation in predator count and Avocet mobbing activity. Another method was used to explore the influence of predator occurrence, weather and climate on mobbing behavior (full details available from AC). There was also exploration of a potential relationship between temperature and predator count via Pearson's r. Statistical analyses were conducted in R 3.5.3 (R Core Team 2019).

Results

A total of 255 individual avian predators were recorded across 44 hours of scan sampling during this study. Carrion Crows were the most common avian predator recorded (n = 151), followed by gulls (n=47) and Grey Herons (n=25). Additional avian predators recorded included Raven (n=21), Buzzard (n=6) and Magpie *Pica pica* (n=5). Carrion Crows were mobbed on 80 occasions (53% of all crow observations), gulls were mobbed 21 times (47%) and Buzzards were mobbed six times (100%). Magpies did not elicit a mobbing response. Direct depredation of an Avocet chick was observed on two occasions, by a Carrion Crow in each instance.

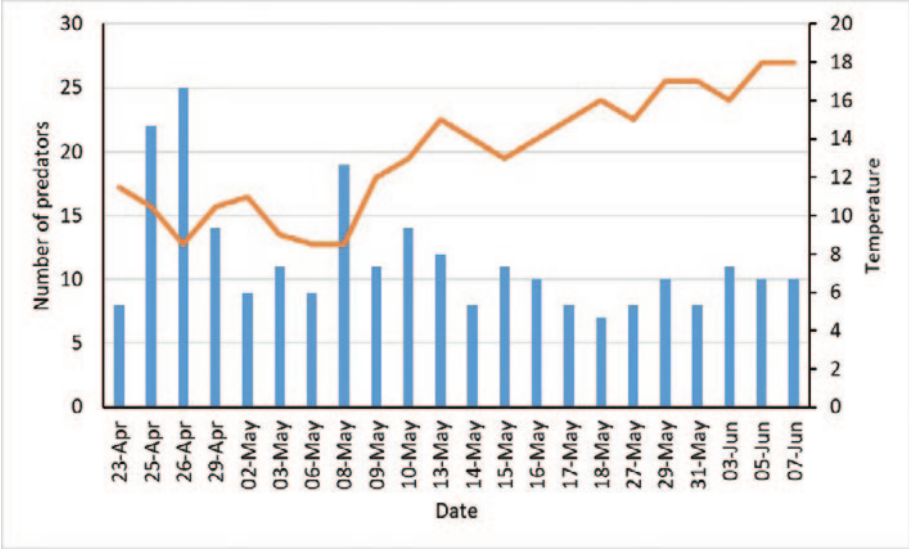


Figure 2. The total number of avian predators observed during morning surveys (bars) and the recorded temperature for each survey period (black line).

Avocet mobbing activity increased with decreasing temperatures (GLM; β = -0.255 ± 0.062, P < 0.0001). Post-hoc correlative analysis of the association between temperature and predator count resulted in a significant association (t_{211} = -2.303, P = 0.022), i.e. more individual avian predators were recorded during colder weather. Temperature was strongly associated with survey date (R^2 = 0.80); colder temperatures were recorded earlier in the breeding season (Fig. 2). There was no significant increase observed in mobbing activity over time.

Variable	β coefficient (± Standard Deviation)	P value
Temperature	**-0.255 (0.062)**	**<0.0001**
Cloud cover	-0.178 (0.119)	0.136
Precipitation	0.102 (0.264)	0.697
Predator count	-0.006 (0.266)	0.979

Table 1. The results of a General Linear Model (GLM) exploring factors affecting Avocet mobbing behavior. Variables are ranked according to P value; significant variables are highlighted.

Figure 3. A Stoat recorded by a camera trap at Goldcliff Lagoons, Newport.

A total of 25 individual mammalian predators were detected across 300 camera days. Brown Rats were the most commonly detected species (n=21). Additional species included Stoats (n=3; Fig. 3) and Red Fox (n=1). A total of 17 detections were recorded between 22:00 and 02:00.

Discussion

The results of this study show that, given the explanatory variables detailed herein, temperature was the only relevant factor explaining temporal variation in the frequency of mobbing behavior of breeding Avocets. Given the observed trends in both predator number and temperature, it may be that our data simply reflect greater predation pressure earlier in the season, when mean daily temperature is lower. Further, it should be noted that no Avocet chicks were observed later than early May, which coincides with a decline in predator observations. However, while the number of individual predators was not a significant predictor of mobbing behavior, responses to predators were not equal. For example, while Carrion Crows were the most frequently recorded predator (n=151), eliciting a mobbing response 53% of the time, and were seen in active depredation of Avocet chicks, they nevertheless elicited a weak community response (i.e. mobbing by a small number of adults; Nicholas Bishop pers. comm.). In contrast, Buzzards were rarely recorded (n=6) and were not observed depredating chicks during the study but nevertheless elicited a strong communal response on each occasion, with adult Avocets mobbing in great numbers (NB pers. comm.). Avocets typically mob potential threats that are larger than themselves (Sordahl 1986) and, indeed, Buzzards were observed to elicit a stronger and more consistent response than any other avian predator.

The high abundance of crows may be partially due to the surrounding habitat; the reserve occurs in an agricultural landscape that may provide enhanced foraging opportunities for the species when compared to other habitats (Mastubara 2003). Opportunistic observations by site wardens suggest that Buzzards are also particularly abundant in the area, despite the lack of records reported herein, and have been observed depredating Avocet chicks (TD pers. comm.). It is unlikely that Avocets represent a substantial proportion of the diet for either species (Graham *et al*. 1994; Miller *et al*. 2014). However, video evidence from the Netherlands suggests that Carrion Crows and Buzzards can be important predators of wader chicks and eggs, with Buzzards being among the most frequently recorded (Teunissen *et al*. 2008).

Mammalian predators were infrequently detected by camera traps during the study (n=25). This is likely to be an artefact of camera number and placement, rather than a true reflection of predatory mammal activity (Kolowski and Forrester 2017). The most frequently detected mammalian predator, the Brown Rat, is a common threat to breeding birds worldwide (e.g. Major 1991; Moors *et al*. 1992; Angelici *et al*. 2012), including Avocets (Norman 1975). Brown Rats are extremely capable swimmers (Brown *et al*. 2000), able to reach the islets of Goldliff Lagoons with ease. It is therefore likely that depredation by Brown Rats contributes to overall Avocet egg and chick mortality rates at Goldcliff. It is important to note, however, that, due to the placement of camera traps, there is no direct evidence of Brown Rats accessing breeding Avocet colonies nor attacking eggs or chicks. Further studies are required to quantify the nature of the threat posed by Brown Rats to breeding Avocets at Goldcliff.

The observation of Stoats inside the protective fencing is also of considerable concern. Stoats regularly consume birds and their eggs (e.g. Green *et al*. 1987; King *et al*. 2001; Macdonald and Bolton 2008) and are capable of depredating a whole clutch in a single attempt (Barlow and Choquenot 2002). Moreover, they are flexible opportunists, able to rapidly shift to alternative sources of food when normal prey become scarce or suitable alternative prey become abundant (King *et al.* 2001). As with rats, Stoats were not observed directly accessing breeding Avocet colonies. However, the potential remains and, indeed, both rats and Stoats pose a threat to other ground-nesting breeding birds at Goldcliff. Monitoring the activity patterns and direct threat posed by these predators poses logistical difficulties in terms of direct or remote observation. During the breeding season, vegetation growth ensures that any terrestrial cameras have a limited field of view and frequently capture moving vegetation. Intervention in terms of cutting vegetation is not currently seen to be a viable option. Further, while cameras might be placed adjacent to active nests by reserve staff, it is currently impossible to position cameras so that they are not triggered by moving vegetation, birds, water, or weather. The issue is exacerbated by the fact that access to the islands is strictly limited during the breeding season and regular camera maintenance is rarely possible and would be less so when alongside active nests. Hence, while cameras ostensibly offer the best method for determining the impact of mammalian predators, there are limited opportunities for deployment at present. However, such data would be of substantial value in providing a more complete understanding of the factors affecting breeding Avocets at Newport Wetlands. Hence, considered and focused deployment of camera traps is recommended, ensuring a more complete coverage than was attempted in the current study.

Localised and relatively isolated breeding bird colonies represent a concentration of readily available resources for predators (*sensu* Manton *et al*. 2019). Heavy depredation of such locations can be anticipated, particularly where predator species are common breeders. Certainly, if a breeding raptor nest, rookery, mammal den or other predator refuge is nearby, it is probably that one or more individuals would indeed visit the same pool of resources multiple times (Bonal and Aparicio 2008). However, predators can exhibit considerable temporal and spatial unpredictability in their movements (e.g. Roth and Lima 2006). Given the lack of suitable explanatory data, we recommend further study into the abundance and diversity of potential wader predators and prey availability in the wider landscape.

Conclusions

The frequency of avian predator sightings and the presence of mammalian predators within the perimeter fence described in this study are of considerable concern. Our results highlight the persistence of threats faced by the small, breeding Avocet population at Newport Wetlands NNR. The results of this study, coupled with further research will help the development of existing and

new management processes to assist the colony to persist in the long-term.

Acknowledgments

Many thanks to Kevin Dupé for setting up camera traps and collecting data. NB carried out fieldwork, analysed data and wrote the dissertation upon which this work is based. AC conceived and developed the project, contributed to the analyses and text and supervised NB. RJF and TD supported the project and contributed to the text, JS contributed to the text.

References

Angelici, C., Marini, F., Battisti, C., Bertolino, S., Capizzi, D. and Monaco, A. 2012. Cumulative impact of rats and coypu on nesting waterbirds: first evidence from a small medditerranean wetland (Central Italy). *Vie et milieu-Life and environment* 62:137-141.

Beauchamp, G. 1999. A comparative study of breeding traits in colonial birds. *Evolutionary Ecology Research* 1: 251-260.

Bonal, R. and M. Aparicio, J. 2008. Evidence of prey depletion around lesser kestrel Falco naumanni colonies and its short term negative consequences. *Journal of Avian Biology* 39: 189-197.

Brown, R.W. and Whishaw, I.Q. 2000. Similarities in the development of place and cue navigation by rats in a swimming pool. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology* 37: 238-245.

Caravaggi, A., Irwin, S., Lusby, J., Ruddock, M., Mee, A., Nagle, T., O'Toole, L., O'Neill, S. and O'Halloran, J. 2019a. Anthropogenic pressures within the breeding range of the Hen Harrier *Circus cyaneus* in Ireland. *Bird Study* 66: 461-470.

Caravaggi, A., Cuthbert, R.J., Ryan, P.G., Cooper, J. and Bond, A.L. 2019b. The impacts of introduced House Mice on the breeding success of nesting seabirds on Gough Island. *Ibis* 161: 648-661.

Cresswell, W. 1994. Flocking is an effective anti-predation strategy in redshanks, *Tringa totanus*. *Animal Behaviour* 47: 433-442.

da Silva, B.F., Pena, J.C., Viana-Junior, A.B., Vergne, M. and Pizo, M.A. 2020. Noise and tree species richness modulate the bird community inhabiting small public urban green spaces of a Neotropical city. *Urban Ecosystems* 24: 71-81.

Dalrymple, T. 2020 Newport Wetlands National Nature Reserve: a review of the first 20 years. *Birds in Wales* 17: 36-55.

Doyle, S., Cabot, D., Walsh, A., Inger, R., Bearhop, S. and McMahon, B.J. 2020. Temperature and precipitation at migratory grounds influence demographic trends of an Arctic-breeding bird. *Global Change Biology* 26: 5447-5458.

Drachmann, J., Broberg, M.M. and Søgaard, P. 2002. Nest predation and semicolonial breeding in Linnets *Carduelis cannabina*. *Bird Study* 49: 35-41.

Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. and Gregory, R. 2015. Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. *British Birds* 108: 708-746.

Evans, P. R. & Pienkowski, M. W. 1984. *Population Dynamics of Shorebirds, in Shorebirds: Breeding Behavior and Populations*. New York: Plenum Press.

Ewins, P.J., Dymond, J.N. and Marquiss, M. 1986. The distribution, breeding and diet of Ravens *Corvus corax* in Shetland. *Bird Study* 33: 110–116.

Frederick, P. C. & Collopy, M. W. 1989. The role of predation in determining reproductive success of

colonially nesting wading birds in the Florida Everglades. *American Ornithological Society* 91: 860-867.

Graham, I.M., Redpath, S.M. and Thirgood, S.J. 1995. The diet and breeding density of Common Buzzards *Buteo buteo* in relation to indices of prey abundance. *Bird Study* 42: 165-173.

Green, R.E., Hawell, J. and Johnson, T.H. 1987. Identification of predators of wader eggs from egg remains. *Bird Study* 34: 87-91.

Grüebler, M.U., Schuler, H., Müller, M., Spaar, R., Horch, P. and Naef-Daenzer, B. 2008. Female biased mortality caused by anthropogenic nest loss contributes to population decline and adult sex ratio of a meadow bird. *Biological Conservation* 141: 3040-3049.

Hernández-Matías, A., Jover, L. and Ruiz, X. 2003. Predation on common tern eggs in relation to sub-colony size, nest aggregation and breeding synchrony. *Waterbirds* 26: 280-289.

Kentie, R., Coulson, T., Hooijmeijer, J.C., Howison, R.A., Loonstra, A.J., Verhoeven, M.A., Both, C. and Piersma, T. 2018. Warming springs and habitat alteration interact to impact timing of breeding and population dynamics in a migratory bird. *Global Change Biology* 24: 5292-5303.

King, C.M., Griffiths, K. and Murphy, E.C. 2001. Advances in New Zealand mammalogy 1990–2000: Stoat and weasel. *Journal of the Royal Society of New Zealand* 31: 165-183.

Klemas, V. V., Field, R. T. and Weatherbee, O. 2004. Remote sensing of coastal wetlands and estuaries, Klaipeda: USA-Baltic Internation Symposium.

Kolowski, J.M. and Forrester, T.D. 2017. Camera trap placement and the potential for bias due to trails and other features. *PLoS One* 12: p.e0186679.

Lavers, C. P. and Haines Young, R. H. 1996. The pattern of Dunlin *Calidris aplina* distribution and abundance in relation to habitat variation in the flow country of northern Scotland. *Bird Study* 43: 231-239.

MacDonald, M. A. and Bolton, M. 2008. Predation of Lapwing *Vanellus vanellus* nests on lowland wet grassland in England and Wales: effects of nest density, habitat and predator abundance. *Journal of Ornithology* 149: 555.

Macdonald, M.A. and Bolton, M. 2008. Predation on wader nests in Europe. Ibis 150: 54-73.

Major, R.E. 1991. Identification of nest predators by photography, dummy eggs, and adhesive tape. *The Auk* 108: 190-195.

Manton, M., Angelstam, P. and Naumov, V. 2019. Effects of land use intensification on avian predator assemblages: a comparison of landscapes with different histories in Northern Europe. *Diversity* 11: 70.

Mastubara, H. 2003. Comparative study of territoriality and habitat use in syntopic Jungle Crow (*Corvus macrorhynchos*) and Carrion Crow (*C. corone*). *Ornithological Science* 2: 103-111.

Miller, R., Schiestl, M., Whiten, A., Schwab, C. and Bugnyar, T. 2014. Tolerance and social facilitation in the foraging behaviour of free-ranging crows (*Corvus corone corone; C. c. cornix*). *Ethology* 120: 1248-1255.

Moors, P.J., Atkinson, I.A.E. and Sherley, G.H. 1992. Reducing the rat threat to island birds. *Bird Conservation International* 2: 93-114.

Moreira, F. 1995. The winter feeding ecology of Avocets *Recurvirostra avosetta* on intertidal areas. I. Feeding strategies. *Ibis* 137: 92-98.

R Core Team. 2019. *R: A language and environment for statistical computing.* R Foundation for

Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Roth II, T.C. and Lima, S.L. 2007. Use of prey hotspots by an avian predator: purposeful unpredictability? *The American Naturalist* 169: 264-273.

Seymour, A. S., Harris, S., Ralston, C. and White, P. C. L. 2003. Factors influencing the nesting success of Lapwings *Vanellus vanellus* and behaviour of Red Fox *Vulpes vulpes* in Lapwing nesting sites. *Bird Study* 50: 39-46.

Simpson, M. and Simpson, A. 1977. One-zero and scan methods for sampling behaviour. *Animal Behaviour* 25: 726-731.

Smart, J., Gill, J. A., Sutherland, W. J. and Watkinson, A. R. 2006. Grassland-breeding waders: identifying key habitat requirements for management. *Journal of Applied Ecology* 43: 454-463.

Smith, C. J., Bright, J. M. and Crook, R. 2017. Cloud cover effect of clear-sky index distributions and differences between human and automatic cloud observations. *Solar Energy* 144: 10-21.

Sordahl, T.A. 1986. Evolutionary aspects of avian distraction display: variation in American Avocet and Black-necked Stilt antipredator behavior. In: Mitchell, R.W. and Thompson, N.S. eds., 1986. Deception: Perspectives on human and nonhuman deceit. New York: Suny Press, 87-107.

Sordahl, T. A. 2004. Field evidence of predator discrimination abilities in American Avocets and Black-necked Stilts. *Journal of Field Ornithology* 75: 376-385.

Swann, R.L. and Etheridge, B. 1995. A comparison of breeding success and prey of the Common Buzzard *Buteo buteo* in two areas of northern Scotland. *Bird Study* 42: 37-43.

Teunissen, W., Schekkerman, H., Willems, F. and Majoor, F. 2008. Identifying predators of eggs and chicks of Lapwing *Vanellus vanellu*s and Black-tailed Godwit *Limosa limosa* in the Netherlands and the importance of predation on wader reproductive output. *Ibis* 150: 74-85.

Varela, S.A.M., Danchin, E. and Wagner, R.H. 2007. Does predation select for or against avian coloniality? A comparative analysis. *Journal of Evolutionary Biology* 20: 1490-1503.

Verga, E.G., Sánchez Hümöller, H.L., Peluc, S.I. and Galetto, L. 2017. Forest fragmentation negatively affects common bird species in subtropical fragmented forests. *Emu-Austral Ornithology* 117: 359-369.

Eagles in Wales: a review of ornithological literature, county avifaunas 1889-2000 and Welsh place names

Dewi Lewis
dewi.ensyl@btinternet.com

Crynodeb

Mae'r erthygl fer yma yn adolygu'r dystiolaeth am statws hanesyddol eryrod, eryr euraid (*Aquila chrysaetos*) ac eryr y môr (*Haliaeetus albicilla*) yng Nghymru drwy edrych ar lenyddiaeth adaryddol mewn papurau newyddion, erthyglau mewn cylchgronau, Adroddiadau Sirol am adar 1889-2000 ac enwau lleoedd yng Nghymru. Daw i'r casgliad mai prin iawn yw'r dystiolaeth fod yr un o'r ddau fath o eryr yn gyffredin a phrinach fyth yw unrhyw dystiolaeth o fagu. Mae'r dystiolaeth yn awgrymu mai rhywogaethau prin, ysbeidiol a chrwydrol oeddynt yng Nghymru. Bu cryn drafodaeth ar statws hanesyddol eryrod yng Nghymru. Awgrymodd Williams *et al*. (2020) bod tystiolaeth o fagu a chofnodi aml. Yn ôl Lovegrove *et al.* (1994), yng nghyswllt eryr môr, "nad oes unrhyw dystiolaeth bod eryr môr erioed wedi magu yng Nghymru.....Mae tystiolaeth adroddiadau pryfoclyd ac anelwig am eryrod yn nythu yng Nghymru mwy na thebyg yn cyfeirio at yr eryr euraid" Mae Williams *et al.* (2020) yn awgrymu bod y dystiolaeth yn adlewyrchu magu a chofnodion "rheolaidd". Fe dderbynir yn gyffredinol bod rhywogaethau o eryrod wedi bod yn gyffredin dros rannau helaeth o Gymru hyd at ganol y bedwaredd ganrif ar bymtheg, ond prin iawn yw'r cofnodion cyhoeddedig cyn canol yr 1800au. Nid oedd yng Nghymru adarwyr brodorol a bu'n rhaid dibynnu ar adroddiadau ciperiaid a thirfeddianwyr fu'n difa ysglyfaethwyr gan eu pasio ymlaen i dacsidermiaid neu yn ddiweddarach adroddiadau offeiriaid Plwyf. Bu ciperiaid yn allweddol ar gyfer darparu cofnodion(er yn aml cofnodion o garcas) ond ychydig iawn â wyddom am effaith a'r rhan â gymerwyd ganddynt ynghŷd â dilysrwydd cofnodion y stadau. Byddai rhain yn faes ymchwil pellach. Tybed a oes rhagor o wybodaeth i'w gael yng nghofnodion y stadau ? Wrth fynd trwy'r llenyddiaeth adaryddol fe ddaeth yn amlwg bod nifer o anghysonderau a gosodiadau camarweiniol yno, felly rhoddwyd sylw penodol wrth geisio dilysrwydd pob cofnod a'u gwirio gydag ffynonellau eraill.

Abstract

This short article reviews the evidence for the former status of eagles, Golden Eagle (*Aquila chrysaetos*) and White-tailed Eagle (*Haliaeetus albicilla*) in Wales on the basis of a review of the ornithological literature gathered from newspaper reports, journal articles, County Avifaunas 1889-2000 and Welsh place-names. It concludes that there is very little evidence that either species were common and that there is even less evidence of breeding. The evidence from the records points to both species being rare visitors to Wales. There has been much discussion regarding the former status of eagle species in Wales. Williams *et al.* (2020) suggested that there was evidence of breeding and frequent records. Lovegrove *et al*. (1994) stated that in relation to the White-tailed Eagle "There is no evidence that White-tailed Eagles ever bred in Wales.....The tantalisingly vague accounts of Eagles possibly nesting in Wales more likely refer to Golden Eagle." Williams *et al.* (2020) suggest that the evidence was of breeding and "frequent" recording. It is thought and generally accepted that eagle species were widespread over much of Wales into the mid-decades of the 19th century, yet there are few published records before the mid-1880s. Wales lacked indigenous ornithologists and had to rely on gamekeepers and farmers who destroyed predators, kept records, passed specimens for taxidermy and later the records of parish priests. Gamekeepers played an important

role in providing records (albeit of carcases) but little is known of the impact of the role that they played and the accuracy of Estate records. This would be an area for future research. One wonders if any further information could be gleaned from archive material on historical Estate records. From the review of the ornithological literature it became apparent there are many inconsistencies and misleading statements in the literature, so particular attention was paid to assessing the validity of each statement by referring to other sources.

Introduction and methods

This short article reviews historical literature of eagle records in Wales It is not intended to be a scientific analysis but an attempt to collate historical records from all parts of Wales. In presenting this short paper I hope to generate further understanding of historical records, archaeological finds and place names relating to eagle species in Wales. I have touched on archaeological findings which would provide new avenues of research, specifically in Wales.

Literature searches were conducted by searching newspapers and journals on the National Library of Wales website. County avifaunas and local bird reports from 1889 to 2000 were also searched. The main documentary sources were the 19th and 20th century ornithological accounts. These accounts include useful information on the presence and former presence of both species of eagle in Wales.

Attempts to reconstruct historical ranges of species inevitably involve much speculation. Studies of this type have many possible sources of error. Consequently it is difficult to validate the assumption that a place name identified as representing eagles by detailed research in one area will do so elsewhere and it is possible that some names may not directly reflect the past presence of eagles. Welsh place name elements denoting 'eagle' do not differentiate between species. This of course is not surprising given the relative novelty of species as a concept and the difficulty in distinguishing between similar species in the days before optical aids. Some wild animal specimens are sufficiently charismatic for their former presence to have been recorded in place names (Ekwall 1960). Although a place name may conceivably be named after a single occurrence of a notable creature, Gelling and Cole (2000) argue that place names at least in parts of Britain tended to describe the landscape in terms of persistent familiar features.

The use of place names in any historical context has its own potential pitfalls. Consider the place name "Llwyn Eryr" on the outskirts of Morriston, south Wales, thought by many as a place name reflecting the presence of the White-tailed Eagle. In reality "Llwyn Eryr" has no connection with any eagle species. Llwyn Eryr was a house built for one of the managers of the Llangyfelach coal pits which were owned and managed by the Eagle Bush Mining Company. "Llwyn Eryr" is the Welsh translation of Eagle Bush. One also has to consider the probability, as does some of the historical evidence, of escaped birds being recorded in the wild. The Golden Eagle in the Tregaron area in recent years springs to mind. Also of note is the statement in Thorpe and Stratford (2021) that "A review of all records in 2020 found that all post-1950 records were likely, or proven to be, escapes". Escaped eagles would not have been an event exclusive to post-1950 years as reported in one newspaper: "EXCITING EAGLE HUNT. An exciting eagle hunt has just taken place at Liverpool. Five large eagles escaped from a vessel in dock, having been brought from abroad for a dealer. They were chased along a number of housetops, but owing to their showing fight, none of their pursuers ventured too near. One of the birds attacked a boy very fiercely, and tore his hand, while another played havoc among a lot of pigeons. The eagles are still at large" (Cardiff Times 29 June 1901). It is not inconceivable that some of these escaped birds would have found their way over the border to Wales in the years following 1901.

Verification of records

References were generally taken at face value but careful attention was paid to the exact wording and implication of the original reference wherever possible. There were several instances where originals were misquoted or embellished. In such instances the record always assumes the status of the original reference. Loosely worded statements were double checked against other relevant references where possible.

Early historical records

There is no shortage of references to eagles in early Welsh prose and poetry such as Canu Heledd and Canu Llywarch Hen or the story of Culhwch and Olwen in the Mabinogion. Williams (2014) in his thesis provided an interesting picture on the symbolism of eagles in the age of the Cywyddwyr. In early Welsh literature the eagle is represented as a symbol of power and status and it is difficult to establish whether a number of these writings actually refer to the present geographical Wales or not. Previously Wales extended from the south-west of England right up into southern Scotland. One cannot dismiss as Dafydd (2015), suggested that some of the place names in Canu Heledd and Canu Llywarch Hen are located in the "Old Powys" just over the border in Shropshire. Canu Heledd describes eagles waiting for the opportunity to feast on the bodies of the dead warriors of battle. On the other hand Elias (2004) also stated that Eryr Gwernabwy in the story of Culhwch and Olwen cannot be completely dismissed as being an Osprey (*Pandion haliaetus*). It is not clear what species of bird these prose and poetical works relate to.

Although records from past centuries are somewhat vague it seems that Golden Eagles were seen regularly in Snowdonia until about the middle of the 17th century. The botanist Thomas Johnson who was collecting plant specimens on Carnedd Llewelyn in 1639 mentioned "the faintheartedness of his guide in his fear of eagles on Carnedd Llewelyn" Carter (1964). Subsequent authors have added to this statement by stating that "eagles nested there" Lovegrove *et al*. (1994) and Barnes (1997). Jones (1993) gives more details and background information to the occasion and one feels that there was rather more to the story than simply the danger of "nesting eagles".

In *c*.1538 John Leland (*c*. 1503-1552) described an eagle's nest at Castle Dinas Brân, Denbighshire, in these terms: "and there in the rok side that the castelle stondith on bredith every yere an egle. And the egle doth sorely assaut hym that distroith the nest, goyng doun in one basket, and having a nother over his hedde to defend the sore stripe of the egle." Interestingly Borrow (1901) quotes a stanza from a poem by Roger Cyffin (*c*. 1589-1609) on Dinas Brân. There is no mention of 'egle'.

"Gone, gone are thy gates, Dinas Bran on the height!
Thy warders are blood-crows and ravens, I trow;
Now no one will wend from field of the fight
To the fortress on high, save the raven and crow"

Had the egle disappeared by Cyffin's time or did Leland add a bit of colour to his account?

All authorities are agreed that the Golden Eagle used to be present in the mountainous districts of Wales. They appear to follow Willughby (a contemporary of John Ray), who, writing in 1678, said that it nested at that time on the high rocks of Snowdonia. Eagles nested in Snowdonia in 1658 and 1662 (Ray and Willoughby's visits). Pennant, writing more than a century later, stated the same in general terms, "This kind of eagle sometimes migrates into Caernarvonshire and there are instances though rare of its having bred in the Snowdon Hills." Forrest (1907) wrote that "no author, so far as I can find out, gives any actual instance of an eyrie being found [....] No specimen has been obtained in North Wales within the last one hundred years. From time to time reports of Golden Eagles being

seen or obtained have appeared in news papers but on investigation these have always proved to be either immature White-tailed Eagles or Common Buzzards."

Edward Lhuyd (1660-1709) printed some information on the Snowdon eagles, more than likely using information given to him by Gulielmus (William) Rowlands. "It is more than sufficiently well established", he said, "that the mountain crags of the British Alps are called Creigie y'ryri (sic) from yr Eryr ab Eryrod, eagles, which according to tradition formerly lived in profusion in that region". He went on: "There is scarcely anyone of the older local inhabitants who has not seen the eagles; an eagle has been seen within the past three years, and people believe there is still one surviving". According to Emery (1985) "Although Rowlands does not state that he saw a golden eagle himself, he is convincing about the testimony for the presence of eryrod in Snowdonia in or about 1690". Rowlands continued: "These birds of prey were once famous for various incidents: for they are said to have snatched up not just tame birds, lambs and sheep, but dogs, calves and swine, and to have devoured larger animals and, not content just with these, to have swooped on men".

There are some archaeological records from relatively few localities that could be included. There is the likelihood that eagle remains may have been transported to their final location by humans either incidentally or deliberately (Grossman *et al*. 2008). Archaelogical records of eagle bones found in Welsh caves have been quoted in many published works Lovegrove *et al*.(1994), Pritchard(2020) and Williams *et al.* (2020). These publications, in general, repeat the same information. However information from the National Museum of Wales (2020) provided us with additional information to consider. Records of two bones from Coygan Cave, Carmarthenshire claiming to be eagle. Identifications are recorded to have been made by Don Bramwell, however, a note on one of these records states that the bones have been looked at more recently by Dr Jo Cooper of the Natural History Museum, who has identified these as simply 'large bird but not eagle'. There is a bird bone from Port Eynon Cave, Gower which is 'unverified and for which there is no credit for the identification'. This is noted on the database as an eagle bone but the bone is unidentified, 'so no doubt caution should be given to this identification'. Further excavation at Cat Hole Cave in 2012 showed that ten pieces of bones were recovered including a coracoid and two conjoining fragments of an ulna belonging to domestic fowl and a proximal phalanx of the major digit belonging to a duck (*Anas/Aythya* spp.). The remainder were only identifiable as a 'bird' with the exception of a passerine, probably Starling (*Sturnus vulgaris*), humerus. There is one bone from Pontnewydd Cave, Denbighshire, identified as either a Golden Eagle or an Eagle Owl (*Bubo bubo*). This identification is by Mrs Anne Eastham and suggests it is a terminal phalange comparable in size with Eagle. See current research on use of phalange bones as pieces of jewellery in neolithic nomad tribes. The final reference is to four eagle bones, without bone identifications given from the excavations in the Museum Garden, Caerleon by J.David Zienkiewicz. This would suggest that further research on archaeological finds could be undertaken to establish further the identity of such bones. Should these archaeological finds be discussed in a wider 'global' rather than 'local' context?

County records

Anglesey

There are a few records from Anglesey (Jones and Whalley 2004). The earliest was of a bird shot at Bodowen Farm, Bodorgan in December 1839. Initially, thought to be of the "species called falcon imperialis or imperial eagle". This bird was later confirmed by the Zoological Society "to be the Golden Eagle, now a very rare bird indeed in the British Islands. It is in mature and perfect condition and will be the more valuable to us from being the only British specimen in our collection". There were unconfirmed reports of Golden Eagle at Tregaian around 1910 and another off the coast of Cemlyn in December 1954. There is some confusion surrounding the Cemlyn record. Walker and McLean

(1961) stated that there was doubt on the accuracy of this record and a subsequent note stated that "an eagle (indeterminate views) seen on Cemlyn, December 1955". There are no recent reliable records for the species for Anglesey. White-tailed Eagles were reported from Cors Erddreiniog on 7 June 1988 and another bird from Trearddur Bay on 14 April 1989, but, these records were "not accepted" (Sandham 2016).

Brecon

The ornithological records mention one Golden Eagle record, a bird killed at "Penbont near Brecon" in around 1859. Cambridge Phillips (1899) after having seen the bird described it thus "I should consider it, from its plumage to be a bird of three or four years old and to have strayed to the Beacons in search of food". There are two records for White-tailed Eagle. One reported by Professor J.H. Salter of one "captured at Dinas, near Cantref at Christmas 1901". The other record refers to a bird that was seen in Breconshire on 11 April 1936. Ingram and Salmon (1957) stated that in their opinion, Phillips (1948) "mistakenly" suggested that, the Golden Eagle was "still to be found" in the county. Phillips mentioned that a farmer Mr. Glyn Francis, Llandegeman Farm had shot a bird near Tretower and that it had been stuffed and preserved at Crickhowell. Lovegrove *et al*. (1994) and Ingram and Salmon (1957) considered this record as "unsubstantiated". Phillips also mentioned a bird that he had observed above Cwmshenkin but gives no date and also mentioned "Golden Eagles observed at Llangynidr, Grwyne Fawr and at Llanigon", again no dates were given for any these.

Caernarfon

Although there are a number of records the details in some cases are unclear, as with the Carnedd Llewelyn 1639 report. The next record was at Beddgelert in 1859. This record was considered as a White-tailed Eagle although Sandham (2016) suggested that it is "considered as doubtful as Golden Eagle was not ruled out".

The records of two birds seen on Glyder Fawr in September 1870 and May 1886 have been disputed. Both sightings were reported on in the press. However, Forrest (1907) noted that "From time to time reports of Golden Eagles being seen or obtained have appeared in newspapers but on investigation these have always proved to be either immature White-tailed Eagles or Common Buzzards. Both in colour and form the latter closely resembles an Eagle and may easily be mistaken for one, unless the observer is near enough to note its smaller size. There is no doubt that the pair of birds seen on Glyder Fawr 30th September 1870 and described by Mr A. G. More as Golden Eagles in the Zoologist as well as another pair in the same place recorded similarly in the Field 1 May 1886 were Buzzards". Love (2013) wrote after "personal communication from Dr W G Hale that 'the last known Welsh pair' seemed to have nested at Carreg y Llam, near Nevin on the Llŷn Peninsula, around 1880".

There was a record for Capel Curig in 1900 for White-tailed Eagle but Sandham (2016) stated that this record should be "considered doubtful as Golden Eagle was not ruled out". The 1910 record for Abersoch is well documented in the literature and was also reported in the press at the time. The eagle was finally shot and injured and taken to Wrexham where it was kept in captivity.

Ceredigion

The first record for Cardiganshire was a bird shot on Plynlimon in November 1887. The bird was reported to Mr Hugh Jerman, Principal of Llandrillo College who described it as a "beautiful specimen of Golden Eagle". It is interesting that a photograph of the shot eagle appears in Aston (1906) and is described as "an immature White-tailed Eagle". A second record was of an immature bird shot at Glandovey in the spring of 1904. The 1910 bird recorded at Aberaeron was considered by Forrest (1907) to be the same bird that was later shot and captured at Abersoch. The 1965 report of a Golden

Eagle in Tre'r ddôl was widely reported in the newspapers and Lovegrove *et al*. (1994) considered this record as "unsubstantiated". The next two records were in the Cors Caron area. On 28 January 1990 an "immature bird was seen over the hillside on the edge of Cors Caron (Roderick and Davis 2010). It was reported that the possibility of "an 'escape' could not be completely dismissed. On 12 November 1997 a "juvenille White-tailed Eagle twice glided over. This bird was not resighted."

Carmarthen
Mathew (1894) reported on a bird shot near Carmarthen that was in the collection of Stackpole Court Pembrokeshire. This bird was reported as "a young White-tailed Eagle". Another bird was reported as having been shot by Mr Lockyer, keeper at Dynevor Castle. Ingram and Salmon (1954) suggest that these records may "refer to the same bird".

One was recorded near Dolaucothy about 1915 but this may have been one of the Golden Eagles released from Skomer, Pembrokeshire.

The most substantial record for Carmarthenshire is of a Golden Eagle reported as shot at Llanelli on 6 October 1908 and described as "the first eagle ever seen in the locality and it caused great excitement".

Denbigh
Apart from the record from Llangollen (*c*. 1538) there are three records for Denbighshire. Two of the records related to possible "immature" birds. A bird was shot in Llanarmon Dyffryn Ceiriog in 1855 and brought to the Hand Inn before being sent to Shrewsbury for preservation. The second record related to a bird shot at Llandrillo in 1862 or 1853 (Pritchard 2012). Some records stated that it was recorded at Crogen. Dobie (1893) reported that "Sir H.B. Robertson has a specimen in the Palé collection, shot on the Berwyns, Merionethshire, near the Denbighshire border, in 1863". There was another possible "immature" bird shot at Bodelwyddan in 1873 described in a newspaper article as a "White-tailed Eagle, a young bird showing no white in the tail."

Flint
There has been one record of a bird shot at Talacre in 1810. A newspaper report of 1884 reported that this bird was "a white tailed eagle of great strength and beautiful plumage was shot. The legs and talons were remarkably large and strong, and feathered all down to the claws. It has a large white spot on the tail whence it derives its denomination". This description would suggest a Golden Eagle.

Glamorgan
Heathcote *et al*. (1967) noted that, "Dodderidge Knight recorded that two eagles of this species were caught at Kenfig Burrows in 1818". In this he may not have been quite accurate since there is in the National Museum of Wales a water-colour by Wm. Weston Young depicting a pair of eagles the female of which is shown caught by her right foot in a gin-trap. A contemporary note is appended apparently in the handwriting of the artist, stating that the bird was taken in 1816 at Kenfig but that the male, though remaining in that part of the country for some time afterwards, could not be caught 'by any contrivance'. It also stated that the unfortunate female was left in the trap for 24 hours (no doubt in the hope that her mate might be taken in another trap or thus enticed within range of a gun). There is also in private hands another water-colour by the same artist of a 'young Sea-Eagle' which was said to have been found at Margam *c*.1810 though there are no supporting data. Dodderidge Knight also recorded two others during severe weather in 1830 and another at Newton Warren "towards Ogmore" in 1833. Two single birds were later recorded, probably quite reliably as

having been seen at Margam in *c*.1840 and *c*.1860. There are still in existence two specimens at Penrice recently examined through the courtesy of Mr Christopher Methuen-Campbell which may possibly be associated with the 1830 birds mentioned above. These two specimens are recorded on their cases in apparently contemporary handwriting; the first simply with the date 'March 7th 1828' and the second dated 2 March 1831 with the legend 'shot by Isaac Stubbs, Cwm Malwg'. Cwm Malwg is, of course at Margam and the birds after being mounted were perhaps taken to Penrice or possibly moved there from Margam at a later date.

Hurford and Lansdown (1995) also reported on records in 1840 and 1848 but gave no further details other than "the species was occurring more rarely by 1848. There was no record subsequent to 1859".

Meirionnydd

As the case with the records for Caernarvonshire there are several, but they are not clear and the number involved ambiguous. The first record was on 13 Nov 1880, a bird seen and shot near Craig yr Aderyn. Sandham (2016) reported that this bird "was preserved at Bala Post Office and now Bangor University". However other reports stated that the bird "preserved" at the post office was the bird obtained on 28 Feb 1899 in the Llangower area. The bird was picked up dead in the neighbourhood, at the foot of a cliff, in 1899, against which it had been dashed by the violence of the wind. However, another report stated, "Its skull was fractured and the lower mandible missing. It is conjectured that the bird met its death in a fight, through jealousy, with another of his species". There was a record of about the middle of April, "a white-tailed eagle was seen on the farm of Hafod Uchel around the 15 or 16th April 1900". The farmer had seen the White-tailed Eagle which was captured at Llangower, near Bala, at the end of February of last year, and he was "certain it was one like it he saw on his farm".

There was a record of a Golden Eagle from the Cwm Bychan area above Llanbedr on 2 July 1909. This individual was considered to be "an immature or unattached bird". Later records were of a bird at Llanuwchllyn in September 1923. Pritchard (2012) suggested that "more recent records are likely to be escaped birds". There was an immature bird reported from Trawsfynydd on 29 November 1965 and an adult at Blaen-lliw near Llanuwchllyn on 20 June 1967.

Then there was a record from the Cwm Croesor area in 1902. This record appears to have gone under the radar as I have not seen it reported in any of the County avifaunas. Forrest wrote (in Bygones, 22 October 1902) that he had "received the following interesting account from Mr Townshend of Oxford, who had read my recent article on the subject:—'I was on Cynicht in the latter part of July this year, with my niece, and saw a pair of Eagles. The one first seen got up below us on the S.W. area of the hill', where it had been feeding on the carcase of a dead sheep..... After a while this first bird was joined by its mate, and the pair continued for some time to soar over Cwm Croesor, between Cynicht and Moelwyn..... I was careful not to mention the matter to the people of the neighbourhood, as it would have been easy to shoot the birds'. The occurrence of a pair of Eagles in July in Wales is so extraordinary that the fact requires to be substantiated without a doubt".

Radnor

There was a record in Ingram and Salmon (1955) of "A noble eagle shot at Beguildy" on 2 December 1835. This was followed by a record of a bird shot in the Llanwern area in December 1896 and described as "brown, streaked with white. The eagle was afterwards presented to Mr D.A. Thomas M.P. on whose preserve it was shot."

Monmouth

In 1985 there was a record of a Golden Eagle from Coed y Prior on 24 March and reported by Venables *et al*. (2008): "The occurrence of a bird in Gwent in 1985 is therefore most remarkable. The bird in question was an immature…….. What was almost certainly the same individual had also been seen in central Wales several weeks earlier".

Montgomery

One was reported over Foel in 1965. Holt and Williams (2008) noted "There has never been a definite record in the county other than one reported at Foel in 1965 which was almost certainly an escaped bird from Pwllheli". A certain Mr Barnes at that time kept a Golden Eagle at Pwllheli. A Golden Eagle was killed following a collision with an ice cream van at Pwllheli.

Pembroke

Mathew (1894) reported a bird seen in the Haverdfordwest area in 1851. This bird was supposed to have been a Golden Eagle, but "with more probability may be considered to have been an immature White-tailed Eagle,...".

The next record was of an "immature" bird that was shot in Whitechurch in February 1908. Donovan and Rees (1994) stated that, "It was erroneously reported as Golden Eagle".

Much has been written about the two Golden Eagles that were kept as captive birds on the Island of Skomer and released in 1915. One of these was shot when it visited the mainland. The remaining eagle remained on Skomer before moving to Ramsey Island in 1928. Another Golden Eagle was brought from London Zoo in an effort to encourage breeding but was found drowned in Ramsey Sound on 9 October 1929. The remaining Skomer eagle was shot in March 1932 and the mounted specimen can be seen at Tenby museum. It was later discovered that the last two birds were both female. Rees (2010) reported a"2nd or 3rd winter bird was seen at Skomer on the 10th and 11th November 1993 which departed along the line of the southern shore of St Bride's Bay but was not seen again".

Resident or passage birds?

Some of the ornithological literature provides further information about the circumstances of the records. Other reports mention the age, sex of the birds and dates of the records. This may provide further insight into past status of eagle species in Wales. General terms such as "Not recorded for over 50 years" Ingram *et al*. (1966), "Very rare vagrant", Roderick and Davis (2010), "A very rare visitor" Green and Roberts (2004) and "Rare vagrant with a possibility of birds being escapes from captivity" Pritchard (2012) were frequently encountered but some of the literature provided further information such as, "This bird was supposed to have been a Golden Eagle, but with more probability may be considered to have been an immature White-tailed Eagle, a species not unseldom observed as a straggler along the western coasts of the kingdom" Mathew (1894).

Edward Lhyud in his revision of the sections on Wales in the second edition of Camden's Britannia (1722), noted that Eagles in Snowdonia "do yet haunt these Rocks some years, though not above three or four at a time, and that commonly one summer in five or six; coming hither, as is suppos'd, out of Ireland". According to Nicholl (1889), "As an accidental visitor the White-tailed Eagle has occurred several times. I have records of nine such occurrences, only four of which, however, are in my opinion reliable".

Cambridge Phillips (1899) stated that "The Eagle (in this instance Golden Eagle) was never very common in South Wales. In relation to the White-tailed Eagle he stated that "Immature examples of

the White-tailed Eagle (Haliatus Albicilla) are observed from time to time on the Sea-bound Counties of England and Wales in autumn and winter when the young birds reared in the North of Europe are migrating towards the South; adults, however are of very rare occurrence. I mention this to show that the bird in question was not bred in Wales".

Of all the historical records in the ornithological literature the most concentrated are those in the Kenfig/Margam area from around 1810 to 1860. Some of these records refer to a pair of birds or young birds. As previously mentioned there is much confusion regarding dates and location. Hurford and Lansdown (1995) offered some additional information to the historical records: "It is believed that these records involved birds from the Scottish and/or Irish breeding population which became extinct after 1916 rather than from Iceland, Scandinavia, Germany or Eastern Europe".

Roderick and Davis (2010) also mentioned, in relation to the records in Ceredigion in the early 1900s that "Considering that this species was nearly extinct in Britain by the beginning of the 20th century, it is extraordinary that there was a series of three records of birds shot in the county at this time. Probably they were immigrants from the continent".

Mathew (1894) also provided further information on the 1851 bird in the Haverdfordwest area and considered to be an "immature White-tailed Eagle, a species not unseldom observed as a straggler along the western coasts of the kingdom." Rees (2010) also suggested that "the 1908 bird must have been an immigrant as none were then breeding in the UK. The 1993 bird may also have been an immigrant but could have come from the Scottish population".

The eagle in Welsh place names

Recent studies on the historical status of eagle species in Wales have included place names containing the element "eryr" in an attempt to trace the historical distribution of eagle species. Some of these studies have made use of "Archwilio" and "Archif Melville Richards". In his assessment, Pritchard (2020) stated that a "total of 78 place names were found, though many of these could not be used in the analysis". After excluding many place names 51 place names in Wales which contained the element "eryr" and that do not appear to be derived from another place name were included. Williams *et al.* (2020) considered that there were 64 place names containing the element "eryr" which were valid for their study. Evans *et al*. (2012) identified 18 Welsh place names containing the eagle component which were classified by place name, language and habitat suitability for eagle species. Twelve of these place names identified were attributed to the past presence of Golden Eagle, four to White-tailed Eagle and two as "unknown". There is a marked difference in the numbers included in these studies and it would be useful for future research to establish the criteria or basis in including specific place names.

In some cases, the same name could have been applied to different species of birds. Earlier evidence of eagle species in Wales may come from place names, though this can be ambiguous since the common Welsh name eryr has been applied to more than one species (Lewis 2006). Yalden (2007) also spoke of exercising caution; "Given that modern tourists to Scotland are reputed to misidentify Common Buzzard as eagles on a regular basis one might ask how reliable is the attribution of [Old English] *earn* in place names to what in modern terms we regard as eagles".

The subject is problematic for various reasons. Does the place name with the element 'eryr' mean that an eagle lived there or was it used to convey a far away location (even after the departure or destruction) of eagles from an area? Eagles have a wide expanse of "territory" then if a place name is named after a 'real' eagle what does this signify? A nesting spot or a location where eagles were

seen, or what? Would a place name be applied if eagles were common at that location or simply applied if it was due to an exceptional record or occurrence?

There is no etymological connection between “eryr” and “Eryri”. The two words were connected’very early and people did ‘believe” (and some continue to do so) for centuries that the meaning of Eryri was/is “the domain of Eagles”. The evidence does suggest that the whole landscape of Wales would have been suitable territory for eagle species at one time but, what can be gleaned from Welsh place names? The Welsh place names do not clearly explain which eagle, or the reason for its origin. It is extremely difficult to be specific apart from simply (or naively) stating that place names generally show that eagles were here in the past. The names would reflect that eagles were here at one time but difficult to assess the significance of this. Take for example “Craig yr Eryr” does this mean, that it is a rock where eagles were common or a rock where one eagle was seen and that this was considered an exception, a one-off event that needed to be recorded and remembered? Or a rock where someone believed they had seen an eagle? Without any firm supporting evidence as to the origin it is difficult to offer anything of substance.

Mathew (1894) noted; “Although one of the highest points of the Precelly Mountains is known by the name of Foel-Eryr "the Eagle's Peak," we cannot ascertain that any species of eagle has nested within recent years in Pembrokeshire, or has been observed as a frequent visitor to the county”.

Conclusion

On balance, it appears that eagle species were known in Wales for many centuries but there is no clear proof that any ever nested here. There is some archaeological evidence, however, that warrants further investigation. Welsh place names containing the element eryr require further research and clarification. In this respect, eagle references are thinly spread over almost six hundred years of records and from the records themselves it is not clear which species of eagle is referred to. The question of any eagle species’ historic breeding status in Wales, has therefore to remain an open question. The ornithological literature, evidence and place names clearly point to eagle species being and remaining as rare visitors in Wales.

References

Aldhouse-Green S., Peterson, R. and Walker, E.A. 2012. *Neanderthals in Wales: Pontnewydd and the Elwy Valley Caves*. Oxford: Oxbow Books and National Museum Wales Books.

Ashton, J. 1906. *Adar ein Gwlad.* Caerfyddin: W. Spurrell & Son.

Barnes, J. 1997. *Birds of Caernarfonshire*. Caernarfon: Cambrian Ornithological Society in Association with First Hydro Company.

Borrow, G. 1901. *Wild Wales: Its People, Language and Scenery*. London: John Murray.

Cambridge-Phillips, E. 1899. *The Birds of Breconshire*. Brecon: Edward Davies.

ap Dafydd, M. 2015. *Yn ôl i’r Dref Wen*. Cyhoeddiadau Barddas.

Dobie, W.H. 1893. *The Birds of West Cheshire, Denbighshire and Flintshire*. Chester: Chester Society of Natural Science and Literature.

Donovan, J. and Rees, G. 1994. *Birds of Pembrokeshire*. Dyfed: Dyfed Wildlife Trust.

Ekwall, E. 1960. *Concise Oxford Dictionary of English Place-names*. London: Oxford University Press.

Elias, T. 2004. *Gwalch y Pysgod/The Osprey* [A survey of historic and modern Welsh language literature/references to the Osprey (Pandion haliaetus)]. Wales: The Forestry Commission.

Emery, F.V. 1985. Edward Lhuyd and Snowdonia. *Nature in Wales: The Quarterly Journal of the West Wales Field Society* 4: 3-11.

Evans, J.R., O'Toole, L. and Whitfield, D.P. 2012. The history of eagles in Britain and Ireland; an ecological review of placename and documentary evidence from the last 1500 years. *Bird Study* 59: 335-349.

Forrest, H.E. 1907. *The Vertebrate Fauna of North Wales*. London: Witherby.

Forrest, H.E. 1919. *A Handbook To The Vertebrate Fauna of North Wales*. London: Witherby.

Gelling, M. and Cole, A. 2000. *The Landscape of Place-names*. Donington: Shaun Tyas.

Green, J. and Roberts, O. 2004. *Birding in Pembrokeshire*. Blaenporth: The Welsh Ornithological Society.

Grossman,L., Munro, N.D. and Belfer-Cohen, A. 2008. A 12,000 year-old Shaman burial from the Southern Levant (Israel). *Proceedings of the National Academy Sciences* 105: 17665-17669.

Heathcote, A., Griffin, D. and Salmon, H.M. 1967. *The Birds of Glamorgan*. Cardiff: The Cardiff Naturalist Society.

Holt, B. and Williams, G. 2008. *Birds of Montgomeryshire*. Welshpool: Private publication.

Hurford, C. and Lansdown, P. 1995. *Birds of Glamorgan*. Cardiff: Cardiff Naturalist's Society.

Ingram, G.C.S. and Salmon, H.M. 1954. *A Hand List Of The Birds of Carmarthenshire*. Tenby: West Wales Field Society.

Ingram, G.C.S. and Salmon, H.M. 1955. *A Hand List of the Birds of Radnorshire*. Hereford: Herefordshire Ornithological Club.

Ingram, G.C.S. and Salmon, H.M. 1957. *The Birds of Brecknock*. Newport: The Brecknock Society.

Ingram, G.C.S, Salmon, H.M. and Condry, W.M. 1966. *Birds of Cardiganshire*. The West Wales Naturalist Club.

Jennings, P. 2014. *Birds of Radnorshire*. Leominster: Ficedula Books.

Jones, D. 1993. Tywysyddion Eryri. Llyfrau Llafar Gwlad Gwasg Carreg Gwalch.

Jones, P.H. and Whalley, P. 2004. *Birds of Anglesey/Adar Môn*. Llangefni: Menter Môn.

Lewis, D.E. 2006. Rhagor o Enwau Adar. Llyfrau Llafar Gwlad Gwasg Carreg Gwalch.

Lockley, R.M., Ingram, G.C.S. and Salmon, H.M. 1949. *The Birds of Pembrokeshire*. Tenby: West Wales Field Society.

Love, J.A, 2013. *A Saga of Sea Eagles*.Dunbeath: Whittles Publishing.

Lovegrove, R., Williams, G. and Williams, I. 1994. *Birds in Wales*.London: T.&A.D. Poyser.

Mathew H.M. 1894. *The Birds of Pembrokeshire and Its Islands*.London: R.H.Porter.

Nicholl, D.S.W. 1889. *Notes on the Rarer Birds of Glamorganshire*. London: West, Newman & Co.

Phillips, W.N. 1948. *The Birds of Breconshire*. Brecon: The Brecon and Radnor Express and County Times.

Pritchard, R. 2012. *Adar Meirionnydd/Birds of Meirionnydd*. Cambrian Ornithological Society.

Pritchard, R. 2020. The prehistoric and historic bird fauna of Wales: evidence from archaeology, literature and place names. *Birds in Wales* 17:15-25.

Rees, G. 2010. *Pembrokeshire Avifauna: All About Birds In Pembrokeshire*.

https://pembsavifauna.co.uk/ Accessed November 2020.

Roderick, H. and Davis, P. 2010. *Birds of Ceredigion*. The Wildlife Trust, South and West Wales.

Sandham, R. 2017. *Scarce and Rare Birds in North Wales Historic records up to and including 2016*. Wales: Private publication.

The Cardiff Naturalist Society. 1900. *The Birds of Glamorgan*. Cardiff: The Cardiff Naturalist Society.

Thorpe, R.J. and Stratford, A. 2021. The Welsh List: A Checklist of Birds of Wales (4th edition). *Birds in Wales* 17: 222-225.

Venables, W.A., Baker, A.D., Clarke, R.M., Jones, C., Lewis, J.M.S., Tyler, S.J., Walker, I.R. and Williams, R.A. 2008. *The Birds of Gwent*. London: Helm.

Walker, T.G. and McLean, I. 1961. Birds of Anglesey: a list. *Transactions of the Anglesey Antiquarian Society*. pp 77-90

Williams, A.H. 2014. *Adar yng Ngwaith y Cywyddwyr Traethawd*. PhD thesis, Aberystwyth University.

Williams, I. 1962. *Enwau Lleoedd*. Gwasg y Brython.

Williams, S., Perkins, S.E, Dennis,R.,Byrne, J.P. and Thomas, R.J. 2020. An evidence based assessment of the past distribution of Golden and White-tailed Eagles across Wales. *Conservation Science and Practice* 2: p.e240.

Yalden, D. W. 2007. The older history of the White-tailed Eagle in Britain. *British Birds* 100: 471-480.

Photo competition - highly commended
Hawfinch: Bob Garrett

Blackcaps wintering in Wales, 1999/2000 – 2020/21

Julian Hughes[1] and Toby Carter[2]

Corresponding author: Julian Hughes wbr@birdsin.wales

[1] Morfa Villa, Pendre Road, Penrhynside, Llandudno LL30 3BY

[2] 6 Main Street, Grimston, Leicestershire LE14 3BZ.

Crynodeb

Cynyddodd nifer y Teloriaid Penddu sy'n gaeafu yng Nghymru yn ystod ail hanner yr 20fed ganrif, ond heblaw mapiau o bresenoldeb a niferoedd cymharol yn Bird Atlas 2007-11, ychydig sydd wedi ei gyhoeddi sy'n asesu eu statws. Mae'r papur yma yn defnyddio data o nifer o ffynonellau i ddisgrifio'r hyn a wyddom am ddefnydd o erddi a thueddiadau mewn niferoedd Teloriaid Penddu fu'n gaeafu yng Nghymru yn ystod y 21ain ganrif, ac yn ceisio asesu maint y boblogaeth.

Abstract

The presence of Blackcaps wintering in Wales increased during the second half of the 20th century, but aside from the maps of cumulative occupation and relative abundance in Bird Atlas 2007-11, little has been published that assesses their status. This paper uses data from multiple sources to describe what is known about garden-use, trends in numbers of wintering Blackcaps in Wales during the 21st century and attempts to assess the size of the population.

Introduction

As a breeding species, Blackcap *Sylvia atricapilla* is widespread in Wales, and has increased significantly in abundance during the last 50 years. Territory density in broadleaved woodlands in Wales increased by 57% between 1965-72 and 2003-04 (Amar *et al*. 2006) and the BBS index for Wales increased by 143% between 1995 and 2018 (Harris *et al*. 2020). As elsewhere in Britain and Ireland, the breeding population migrates to the south and is replaced by a far smaller wintering population from Europe.

Summering Blackcaps sometimes stay beyond late October, but such occurrence was significantly unusual to be noted by early authors, such as one being "pugnacious" to other birds in a Porthmadog garden in January 1906 (Forrest 1919). Blackcaps were noticed in Welsh gardens during the winter with increasing regularity in the 1960s, initially in southeast Wales (e.g. Hurford and Lansdown 1995), but more widely by the 1980s when the first spatial information became available. The species occurred in 30% of 10-km squares in Wales, scattered around the lowlands, during the four winters of the Britain and Ireland Winter Atlas 1981-84 (Lack 1986).

Orientation studies of Blackcaps captured during the summer in central Europe found that birds showed a strong tendency to move to the north-west corner of their aviary in autumn, leading Berthold (1992) to hypothesise that this was the source of the increasing numbers of Blackcaps wintering in Britain. Blackcaps caught in Somerset during the winter and translocated to aviaries near Lake Constance on the Swiss/German border produced young that, in their first autumn, showed the same directional tendency, demonstrating that this was likely to be the result of a genetic change that had occurred in just a couple of dozen generations. Berthold and Pulido (1994) subsequently proved that the direction of travel was set by the birds' genes: the first birds to make the journey, perhaps by accident, returned to their breeding areas earlier in spring than those that had migrated to the south, so the 'north-western' birds paired up with each other and thus the genetic selection

for migration to Britain and Ireland was strengthened.

The trait for wintering in Britain is not restricted to the area of the original southern German studies, but extends from north-east Spain through France and central Europe as far as the Polish border with Ukraine, a distance of over 2,000km. British-wintering Blackcaps arrive back in their European breeding area, on average, 10 days earlier than those that migrate south (Delmore *et al*. 2020).

Garden bird feeding in Britain has provided favourable conditions to aid the overwinter survival of these migrants from mainland Europe, particularly in the second part of the winter, when the autumn berry crop is exhausted and invertebrates are in short supply. Blackcaps were recorded more often in UK gardens that provided food more frequently, and this association with supplementary feeding increased between 1999/2000 and 2010/11 (Plummer *et al*. 2015). A survey found that 70% of Blackcaps wintering in gardens fed on fat-based foods, such as suet balls, and 35% on sunflower seeds (BTO 2013).

Methods

Data from five surveys were used in this review. Each has a different purpose but, in the absence of a dedicated survey, together they describe the occurrence of wintering Blackcaps in Wales. The data used are from December, January and February unless otherwise stated as it can be assumed that Blackcaps here during December-February are almost exclusively visitors from Europe. Blackcaps arrive in Britain from mainland Europe from mid-September, with the bulk of arrivals in mid-October (Ozarowska 2012). Records from Skokholm and Bardsey bird observatories indicate that most movement by Blackcaps has ceased by early November and resumes from mid-March (Pritchard *et al*. 2021).

Bird Atlas 2007-11 (Balmer et al. 2013)

The most complete assessment of the distribution of Blackcap can be derived from the two winter Atlases of Britain and Ireland (Lack 1986, Balmer *et al*. 2013). These provide robust evidence of the spatial distribution at scale of 10-km squares (hectads) for the months November-February.

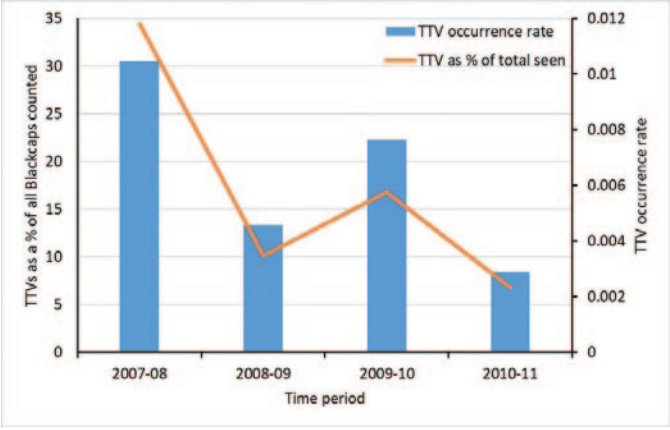


Figure 1. Blackcaps recorded on Timed Tetrad Visits in Wales in each winter of Bird Atlas 2007-11 as a proportion of all Blackcaps seen during each winter. The secondary y-axis (TTV occurrence rate) is the mean number of individual Blackcaps from two visits divided by the total effort (number of tetrads surveyed).

During the Atlas, Timed Tetrad Visits (TTV) were undertaken in a minimum of eight of the 25 tetrads in each 10-km square in order to estimate relative abundance. For Blackcap, these were shown at a 20-km square level in the Atlas, based on the mean number of TTVs in which the species was recorded annually over the four winters (**https://app.bto.org/mapstore/StoreServlet**). The Atlas data do not estimate the density of occurrence as the TTVs surveyed may not reflect the distribution of a species' habitat. In suburban areas, in particular, Blackcaps may not have been visible to surveyors within enclosed gardens.

TTV effort was not equal across the four winters: almost one third (32.4%) of all tetrads surveyed in Wales were completed in 2007/08, with 23.0%, 22.2% and 22.4% completed in the successive three winters. While the number of Blackcaps recorded during each year of the Atlas was very similar (see results), the variable TTV effort has been accounted for by generating a Blackcap occurrence rate and assessing the proportion of the total that came from TTVs (fig.1).

The occurrence maps in Bird Atlas 2007-11 also used casual records collected in BirdTrack, by BTO Garden Birdwatch, bird clubs and the ringing scheme, but only TTV data were used to calculate relative abundance. All tetrad data collected was made available to us by the BTO and for this analysis, a minimum number of Blackcaps reported in each tetrad was calculated by using the highest count in each of the four winter periods from any source. We used November records, as well as December-February. Approximately 18% of 10-km squares occupied during the four winters of the Atlas reported the species only in November.

BTO Garden BirdWatch

Garden BirdWatch (GBW) is designed to find out how and when birds and other animals use gardens. Subscribers submit weekly lists of garden birds and other wildlife (**bto.org/our-science/projects/gbw**) and many submit records for a number of consecutive years. During 2000-20, the number of gardens participating in Wales declined consistently from a peak of 587 in 2003 to 343 in 2019. There was a surge in participation (to 679 gardens) in 2020, which occurred after April when the scheme was made free during the COVID-19 lockdown, and is unlikely to have affected the results in December 2019-February 2020. Some increased participation continued into 2021, when records were submitted from a maximum of 456 Welsh gardens in January/February (mean 2000-21=466) (fig.2). Although the sample size is small compared to the other data sources, the GBW provided the most robust trend information for Wales, since counts were collected consistently across a broadly similar suite of gardens. Trends in reporting rate and the mean number of Blackcaps per garden can be computed.

The GBW is less useful for estimating population size across Wales, however. Participants have a high level of interest in their garden birds, and almost all provide supplementary food, compared to an estimated 64% of households in the wider population (Davies *et al*. 2012). It is uncertain how representative participants' gardens are compared to the rest of Wales. Numerically, gardens in the local authority areas of Powys, Cardiff, Carmarthenshire, Ceredigion and Pembrokeshire are the top five contributors of records to GBW, whereas the South Wales valleys in particular are under-represented in relation to the potential number of households. Research in England and Scotland has shown that house type, household size and the age of the head of the household are important predictors of bird feeding (Davies *et al*. 2012) and this is important when considering the population of a bird that makes considerable use of supplementary feeding.

RSPB Big Garden Birdwatch

This mass participation survey has been undertaken on the last weekend of January almost every

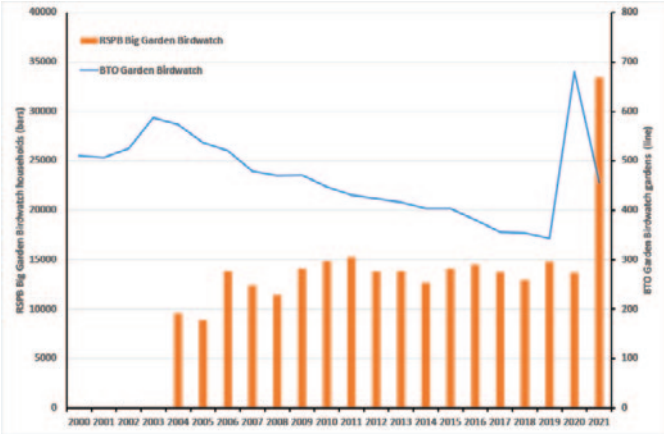


Figure 2. Number of contributors to RSPB Big Garden Birdwatch and BTO Garden BirdWatch in Wales. Note the increase in BTO contributors in 2020 occurred after April, so does not reflect the previous winter period. Those for 2021 relate only to January and February.

year since 1979. Initially a project for young people, organised by the Young Ornithologists' Club, its adoption as a public engagement tool for a wider audience, with a web portal capable of capturing the large number of records, has encouraged a greater number of people to participate (fig.2). Data from the Big Garden Birdwatch (BGBW) were available for Wales from 2004 onwards.

The survey provided a snapshot of birds present in participants' gardens (or a local greenspace) during one hour on one weekend of the year, so was more prone to variable results than the BTO Garden BirdWatch, as a result of the weather and the experience of participants. However, the mass appeal of the RSPB survey resulted in a participation rate (number of gardens) in Wales that was more than 30 times higher than the BTO survey. It also included a greater variety of garden-types and spatial distribution of locations (mean=14,323 gardens during 2004-21). More Blackcaps were recorded in this survey than in any other used in this review.

BirdTrack

The online BirdTrack portal is a partnership between the BTO, the RSPB, Birdwatch Ireland, the Scottish Ornithologists' Club and the Welsh Ornithological Society. It provides a platform for observers to manage their bird records, which can be analysed collectively to look at migration movements and distributions of birds throughout Britain and Ireland. The scheme is year-round and encourages the recording of timed Complete Lists. The proportion of Complete Lists containing a given species provides a measure of frequency of occurrence over time, but the habitats in which these lists are collected are not representative (e.g. Boersch-Supan and Robinson, In prep.).

Participation grew steadily from the late 1990s, and during 2016-20, more than 400,000 records were submitted annually in Wales. Complete Lists averaged 18,375 each year. For this analysis, only records from winters (December-February) in 2011/12 to 2020/21 were used, since these were the years of greatest participation, accounting for 79.2% of all records submitted since 2000.

In the context of this review, BirdTrack was a medium-participation source: more people contributed than to the BTO Garden BirdWatch, but fewer than the RSPB Big Garden Birdwatch. Regular

contributors tended to be active birdwatchers, visiting a wide range of sites and were not restricted solely to gardens. This provided a measure of the proportion of Blackcaps that occur in gardens, to provide context to the other sources.

This analysis used all Welsh Blackcap records for the winter periods 2011/12 to 2020/21. Where a species was recorded only as 'present', this was considered to be a single bird, as a minimum. There were 1,798 records from 748 locations, but after sorting by grid reference, it was clear that many records related to multiple observance of the same individual Blackcaps at a regular location, such as the observer's garden, during the same winter. Following de-duplication, and allowing for the fact that in some gardens different birds were present during the same winter, the dataset consisted of 660 individual Blackcaps at 467 locations.

North Wales 2021 records

An inquiry was undertaken by TC during January 2021, requesting records through four Facebook wildlife groups in North Wales that were followed by 13,800 users, and supplemented by reports from a local WhatsApp group and solicited from a regional daily newspaper. North Wales was defined as the vice-counties of Meirionnydd, Caernarfonshire, Anglesey, Denbighshire and Flintshire adopted by the Welsh Ornithological Society. Details recorded were location, number of Blackcaps and whether the birds were male or female/second calendar-year type. A total of 155 records was received, involving 254 individuals. The inquiry did not request null records and since an unknown number of users belonged to more than one Facebook group and some lived outside the region, it was not possible to assess the reporting rate. Participation was self-selecting, as were all the other datasets used in this review with the exception of Atlas TTVs. The distribution map produced should be regarded as a minimum, as people living in apparently unoccupied squares may not have been aware that the survey was taking place and, unlike the Atlas, no effort was made to record Blackcaps in squares selected at random.

The inquiry (TC pers comm.) incorporated records from BirdTrack, but these were removed in this analysis in order to avoid duplication. In fact, only six records were removed, which illustrated that this crowd-sourcing method resulted in far more records than would have been evident from BirdTrack in the same period.

Results

Distribution of wintering Blackcap in Wales

Bird Atlas 2007-11 (Balmer *et al*. 2013) recorded Blackcap during November-February in 121 10-km squares in Wales, 46.2% of the total available. This represented a 62% increase in the number of 10-km squares occupied in 1981-84 (Lack 1986), although this was lower than the 77% increase that occurred in Britain and Ireland as a whole. In Wales, increases occurred across all lowland areas, although at a slightly higher rate south of the Dyfi estuary than to the north.

However, the mean number of 10-km squares occupied by Blackcap during November-February in any one of those four winters was 58 (55-60), 48% of the cumulative total. Of the 121 10-km squares in which Blackcap was recorded during winters 2007/08-2010/11, the species occurred in only 18 (14.9%) in all four winters, in 32 (26%) squares in three or four winters, and in 62 (51%) squares in two or more winters. Thus, the occupancy maps in Bird Atlas 2007-11 exaggerated the presence of Blackcaps in any one winter during that period by about double.

In the Atlas, the vast majority of occupied squares were below 300m altitude and were primarily along the coast, although some higher elevation squares in south-east Wales were occupied. Relative

to the rest of Wales, there were fewest in Ceredigion, Radnorshire, Montgomeryshire, Meirionnydd, and in Caernarfonshire away from the north coast. Abundance in Wales was lower, relative to similar latitudes in England and Ireland, reflecting the influence of altitude on the likelihood of occupancy. The increase since 1981-84 is illustrated by the only winter atlas undertaken at a tetrad level in Wales, in East Glamorgan in 2007-11 (Glamorgan Bird Club 2014). There, the number of occupied 10-km squares increased from seven (41%) in 1981-84 to 14 (82%) in 2007-11. In the latter period, 14% of tetrads were occupied, but there was a distinct difference between the north and south (separated at latitude 51°35′49″ N, broadly a line running east from the southern edge of Maesteg to the northern edge of Caerphilly). Only 3.8% of the 158 tetrads north of this line were occupied compared to 12% of the 409 tetrads to the south. Concentrations were evident around the suburbs of Cardiff, Barry, Caerphilly and Porthcawl.

Locations of sites with records collected in the North Wales January 2021 inquiry were mapped (TC, pers. comm.) and the distribution by 10-km square compared to Bird Atlas 2007-11 (fig.3). The number of squares occupied in each of the four winters of the Atlas was 17, 12, 14 and 14, and collectively across the four years Blackcap was present in 35 of the region's 96 10-km squares. In January 2021, In January 2021, Blackcap was recorded in 37 of the 10-km squares in North Wales, more than the four winters of the Atlas cumulatively. The methods and effort were very different, so the results are not comparable, but this suggests either that Blackcaps were far more widespread in 2021 or that the 2007-11 Atlas results greatly under-represented the true presence of the species, especially in gardens.

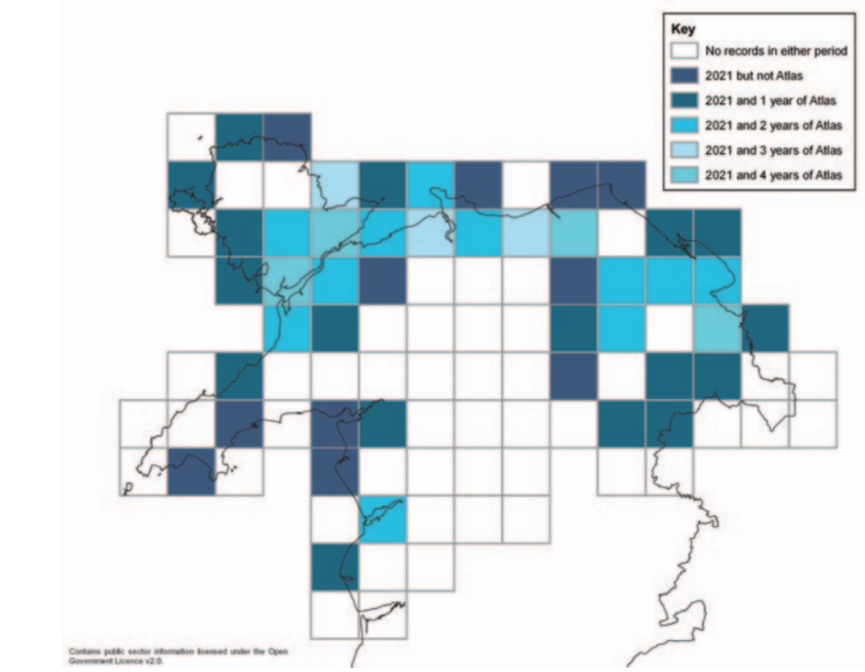

Key
No records in either period
2021 but not Atlas
2021 and 1 year of Atlas
2021 and 2 years of Atlas
2021 and 3 years of Atlas
2021 and 4 years of Atlas
Contains public sector information licensed under the Open Government Licence v2.0

Figure 3. Occurrence of Blackcap in North Wales by 10-km square. Outline square = one or more winter periods in 2007-11 but not January 2021. Black = January 2021 only. Shades of blue = January 2021 and one winter, two/three/four winters during 2007/11.

Using the data for all four Atlas winters and January 2021, Blackcap occurred in 46 of the 96 (48%) available squares in North Wales across both periods. Of the nine squares occupied in 2007-11 but not 2021, one (SH68) on Anglesey contains only a small amount of land, two in south Denbighshire (SJ13 and SJ24) contain very little human habitation and two (SJ37 and SJ45) are on the English border, with less than 20% of the square in Wales.

Finally, the elevation and distance from open coastline of all records (n=465) with sufficient resolution from BirdTrack and the North Wales Inquiry were analysed. The vast majority (86%) of records were within 10km of the coast and 9% were in a band 10-20km away. The remaining 5% were 20-60km from the coast, and none was more than 60km away. Welsh Blackcap records in winter were predominantly lowland: 82% below 100m asl, and all bar two records (0.4%) were below 300m.

Use of gardens by Blackcaps

The records in Bird Atlas 2007-11 did not distinguish between those seen in gardens and those from the wider countryside. The BTO Garden BirdWatch records Blackcaps solely in gardens, and those submitted to the RSPB Big Garden Birdwatch are primarily in gardens. Although the North Wales Inquiry in January 2021 did not request information about habitat type, since it was undertaken during a period of COVID-19 lockdown, which prohibited exercise that did not start and finish at home, it is assumed that the vast majority of records were from the contributors' own garden or in a residential area.

BirdTrack records can provide some indication of the proportion of Blackcaps in gardens, although there is an inherent bias if users are more likely to include a Blackcap record in their own garden outwith a list. All Blackcap records from winters 2011/12-2020/21 were sorted by grid reference and de-duplicated to ensure that each location was recorded only once. Each location was attributed to a Garden based on the description of the location, a specific address or where birds were noted attending a feeder. Sites were attributed as Non-garden if the site description was clearly not a garden (e.g. urban park, university campus, nature reserve or a rural location). The remainder, where there was any uncertainty (such as where the grid reference was of low resolution), were listed as Unknown.

Of 311 locations that recorded Blackcaps during this period, 27 were excluded from the analysis as Unknown. Of the 284 where there was sufficient information to determine the type of site, 70.4% were Gardens and 29.6% were Non-gardens.

Frequency of occurrence

BirdTrack data was used to assess the number of years during 2011/12-2020/21 in which a Blackcap was recorded at the same location (fig.4). Of the 311 locations, 75% recorded Blackcap only once, 23% in 2-4 years and 2% in five or more years. The recurrence rate (2+ years) was similar at sites classed as Gardens (29% of garden records), Non-gardens (31%) and the Unknown types (27%). Only three locations recorded Blackcap in more than five years. These were all in the same area: in nine of the 10 years in Magor and Undy, Gwent (in adjacent 1-km squares) and in six of the 10 years in tetrad ST48I, which comprises both Magor and Undy.

Density of Blackcaps

The mean count of Blackcaps in each record was very similar in both the 10 years of BirdTrack data (1.25/record) and the RSPB Big Garden Birdwatch (1.21/record), with very similar levels in each year of both schemes, except the RSPB survey in 2012/13, which was markedly lower (fig.5). The mean count per site in the North Wales Inquiry in January 2021 was higher (1.64/record), but this may be

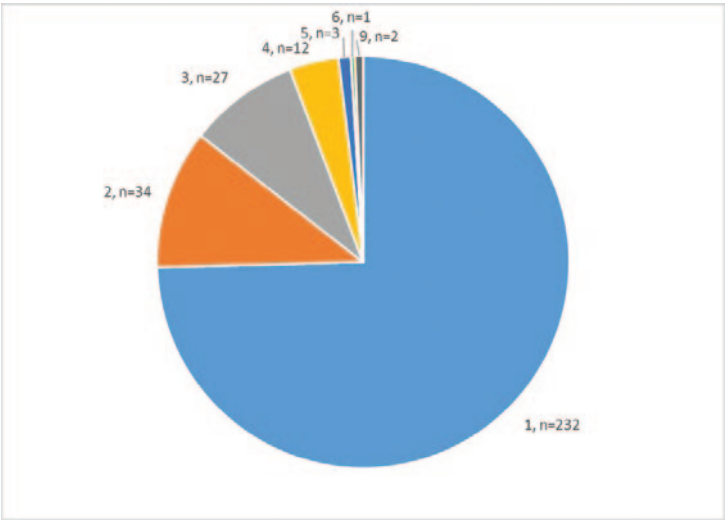


Figure 4. Occurrence of Blackcap in same location in consecutive years, recorded on BirdTrack (labels show the number of years, e.g. 1, and the number of locations n).

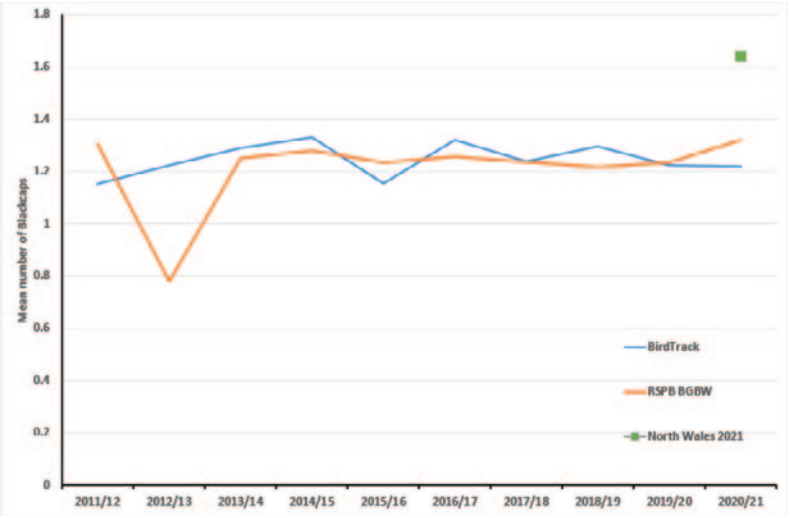


Figure 5. Mean number of Blackcaps per location from records in BirdTrack, RSPB Big Garden Birdwatch and the North Wales Inquiry 2021.

because only the maximum count for the whole month was reported for each site.

In 96 10-km squares in North Wales, the 2021 Inquiry recorded 254 Blackcaps, 2.65 individuals/square. In the same area during the 2007-11 Atlas, combining both TTV and casual records (and assuming that where no count was submitted for the latter, a minimum of one bird was present),

the average number of birds recorded each winter was 33.3 (28-37), which equates to 0.34 individuals/square (0.29-0.39). The proportion of 10-km squares with no Blackcaps was similar in both periods (63% in 2007/08-2010/11, 59% in 2021), but there were far more counts of three or more individuals in a 10-km square in 2021 (21%) than in the best year in each square during 2007/08-2010/11 (7%) (fig.6). The only square in 2007/08-2010/11 with more than 10 Blackcaps was SJ35 (Wrexham North), which contained 12 birds, whereas in January 2021 nine 10-km squares held more than 10 individuals: three in the Dee Valley between Froncysyllte (Denbighshire) and Connah's Quay (Flintshire) and six running east from south-west Anglesey to Rhyl and Prestatyn (Denbighshire). The results from the Atlas and the 2021 Inquiry are not comparable because of very different methods of data collection, but there was far greater effort during the Atlas than in the 2021 inquiry, and so it seems likely that the increased occurrence in 2021 was genuine.

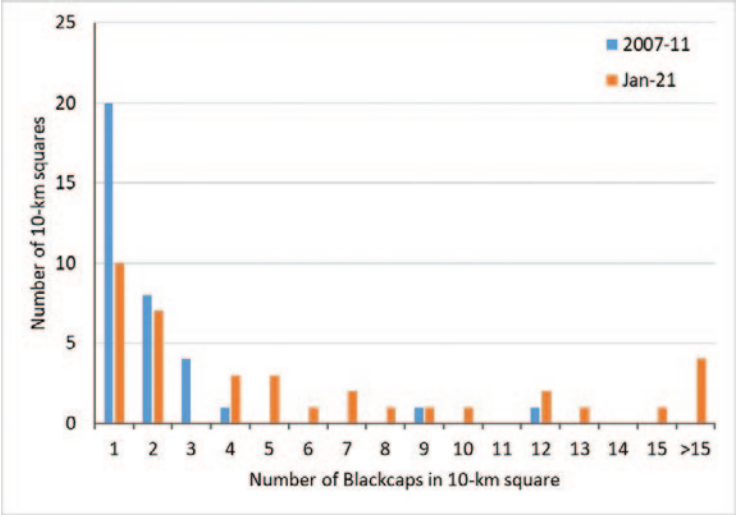


Figure 6. Numbers of 10-km squares in North Wales in which Blackcaps occurred. Blue = during the winter of highest count during 2007-11. Orange = counted in January 2021. Zero counts are excluded (n=60 in 2007/08-2010/11, n=57 in Jan. 2021).

Timing of visits to gardens

In the 22 winter periods between 1999/2000 and 2020/21, the reporting rate of Blackcap in the BTO Garden BirdWatch was highest in January in 10 years, in February in 11 years and jointly between the two in the remaining year.

The GBW reporting rate was higher in some winters than others (fig.7), notably in 2009/10, 2010/11 and 2020/21 when the winter contained periods of cold and/or snowy conditions. That suggests that there is a wintering population of Blackcaps outside gardens that are attracted to supplementary food only when the weather makes feeding on natural sources more difficult. Alternatively, wintering Blackcaps from northern and eastern Europe may move into Wales during bad weather. However, with the exception of the Low Countries, almost all of Europe's wintering Blackcaps are to the south of Britain (**eurobirdportal.org**) and there is no evidence from ringing schemes that such movement occurs within a winter.

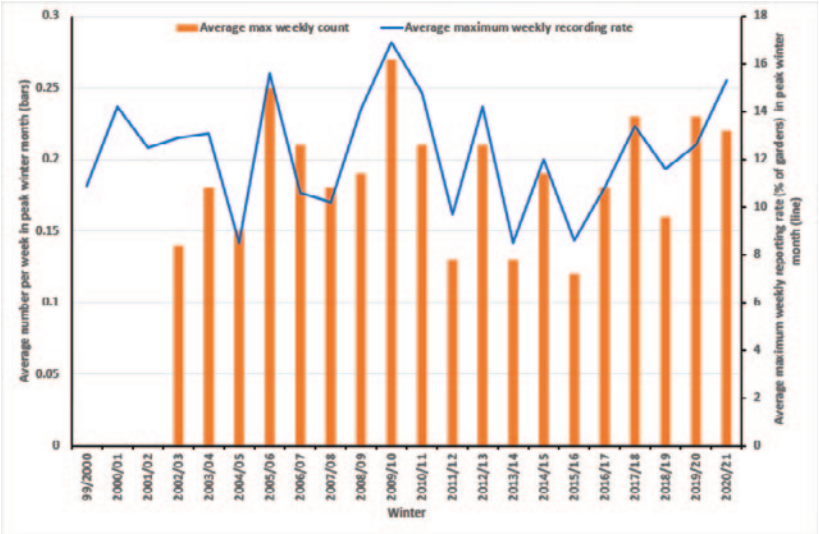


Figure 7. Blackcap occurrence in gardens participating in BTO Garden BirdWatch, 1999/2000-2020/21. Data downloaded from **bto.org/our-science/projects/gbw/results/long-term-patterns** in March 2021.

The GBW reporting rate in March is always lower than in the two preceding months, although it was higher in March 2018 relative to the same month in other years, suggesting that two periods of anticyclonic weather in late February ('the Beast from the East') and mid-March, Blackcaps remained in gardens rather than depart for breeding areas in central Europe.

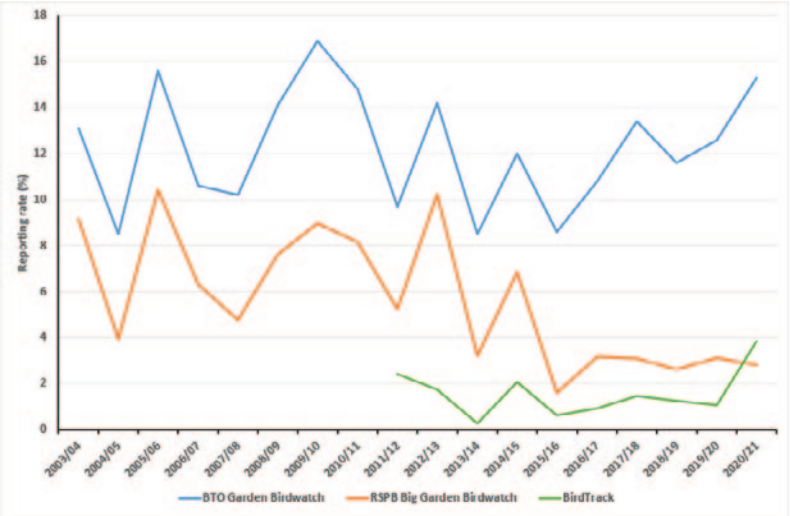


Figure 8. Blackcap reporting rate in gardens participating in BTO Garden BirdWatch and RSPB Big Garden Birdwatch, and as a proportion of lists submitted to BirdTrack in December-February.

Trends in wintering Blackcap numbers

The BTO Garden BirdWatch provided the most robust evidence of the trend in use of gardens by Blackcaps. The mean reporting rate in the peak month across the 22 winters was 12.3%, with no significant trend over time (fig.8). The trend in reporting rate shown by the RSPB Big Garden Birdwatch was broadly aligned to that of the BTO Garden Birdwatch during 2003/04-2016/17, although the actual reporting rate was, on average, 48.5% lower. This is not surprising, since recording effort was far greater in the BTO survey and covers the whole winter period. Since 2017/18, the reporting rate by the RSPB BGBW has been far lower (77.8%) than that of the BTO GBW. It is not apparent what accounts for this, which is not a product of a significant change in the number of participants in either survey until 2021.

The proportion of BirdTrack lists that included Blackcap during 2011/12 to 2020/21 was 1.5% of lists submitted, but varied between 0.3% and 3.8% of lists. The reporting rate is, as would be expected for a non-structured survey in which recording occurred in habitats that are unsuitable for Blackcaps, lower than the two garden-based projects.

The reporting rate for BirdTrack and BTO GBW indicated that, while the number of Blackcaps overwintering in Wales varies between years, the trend has been stable. The minimum number of Blackcaps recorded during Bird Atlas 2007-11 was also consistent across the four winters (122, 128, 125, 117), although the proportion of TTVs counted was much lower in the second, third and fourth years than the first.

This stable situation comes after four decades of growth assessed from both *ad hoc* records and the Atlases, suggesting that much of the expansion in range following the 1981-84 Winter Atlas was before 2000.

Estimating the number of Blackcaps wintering in Wales

The Avian Population Estimates Panel has not made an estimate of the wintering population of Blackcaps for Britain or the UK, including in its most recent report (Woodward *et al*. 2020), so there is no baseline from which to make a Welsh population estimate as has been done for many breeding species in Wales (Hughes *et al*. 2020). Approximately 13% (10.1-16.0%) of Blackcaps recorded on all TTVs in Britain during Bird Atlas 2007-11 occurred in Wales, so if APEP was ever to make an estimate for Britain, it would be straightforward to extrapolate from that.

None of the data sources available generate counts or estimates of density from which a population size can be estimated with confidence. However, two sources may provide the basis of a guesstimate.

a. North Wales 2021 Inquiry

A total of 254 Blackcaps was recorded in North Wales in 2021, a mean of 2.64 per 10-km square in the region. Simply extrapolating this across the 262 10-km squares in Wales suggests a total of 692 individuals or, based on the counties in this survey representing 29.7% of Wales' land surface area, a total of 855 individuals. However, since relative abundance in the Bird Atlas 2007-11 was higher in the south than the north of Wales, and a greater proportion of the latter lies above 300m where Blackcaps occur rarely in winter, this is certainly an underestimate.

An alternative approach, since there is a strong association of wintering Blackcaps with gardens, is to use data on housing stock (Welsh Government 2020). The six local authorities that cover the five North Wales vice-counties account for 325,100 of the 1.413 million properties in Wales (23%), so by extrapolation, an inquiry of this type applied to the whole of Wales should have found 1,104

individuals in January 2021.

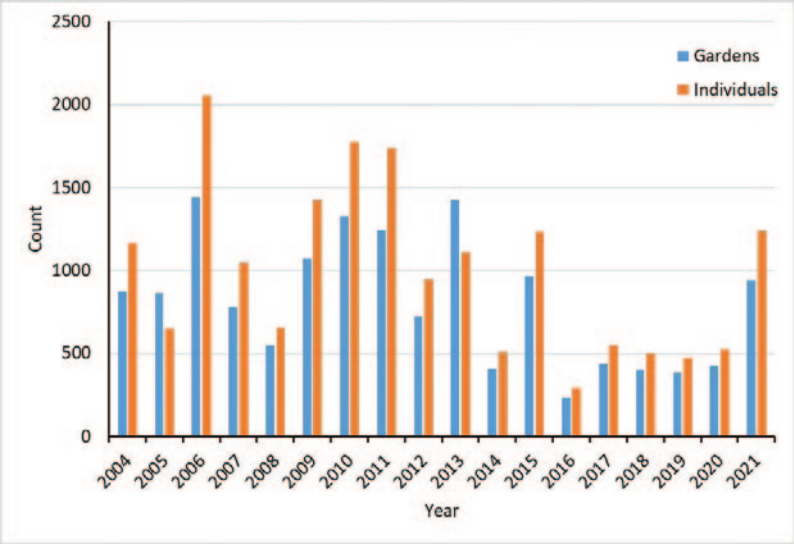


Figure 9. Blackcaps recorded in Wales and the number of gardens recording Blackcap during RSPB Big Garden Birdwatch.

b. RSPB Big Garden Birdwatch

The number of gardens in which Blackcap was recorded was multiplied by the mean number seen in each garden to produce the number of individuals in each year (fig.9). This shows considerable variation, as expected for the reasons described above, between 288 in 2016 and 2,054 in 2006 (mean=994).

Discussion

This review used multiple sources to suggest that 54-70% of wintering Blackcap records in Wales occur in gardens, even though gardens constituted only 1.7% of UK land surface area (Buck 2016; no data is available for Wales). Occurrence in gardens is highest in January and February, and numbers increased during periods of cold weather, suggestive that the population is more widespread across the countryside until pushed into gardens to find a more reliable source of food. In 10 of the 21 years of BTO Garden BirdWatch data assessed, the highest reporting rate of the year was later than the winter months, generally in April. That was the case in every year during 2012-20 compared to just one year during 2000-11, which suggested that a further change may be underway: either wintering birds are staying later (unlikely given the evidence of dates of return to breeding grounds; Delmore *et al*. 2020), or Welsh breeding individuals wintering in the Mediterranean are making greater use of gardens, at least on arrival.

Blackcaps are more likely to be recorded in gardens than non-garden habitats, but only infrequently recur in the same gardens in successive years. Only 1% of BirdTrack locations that recorded Blackcaps did so in at least five of the 10 years. The average lifespan of a Blackcap is two years, so it is possible that individuals return to the same gardens in successive years. However, if Blackcaps gravitate

towards gardens because they provide suitable food resources, it is likely that multiple generations are involved. It would be fascinating to know whether the young of wintering birds visit the same sites as their parents before them.

The mean number of Blackcaps at a given location on any one day (BirdTrack and RSPB Big Garden Birdwatch) has consistently been 1.2-1.3 individuals over the last 10 years, indicative that the population is stable. In the North Wales Inquiry in January 2021, 61% of reports were of full-grown males (TC, pers. comm.), which suggests either that males are more obvious to observers, by their behaviour or plumage, or there is a differential migration between sexes among the mainland European breeding population that winters in Britain. Although, only 1-2 individuals may have been seen in a garden at once, ringing effort in gardens shows that turnover can be higher across a winter. For example, in winter 1984/85, when the population was almost certainly lower than today, 11 Blackcaps were ringed in a garden in Bangor (Caernarfonshire) (Pritchard 2017). Therefore, the numbers involved in any survey or inquiry are likely to be minima.

Blackcaps remain a species found almost exclusively below 300m altitude in Wales, primarily along the coastal plains of North and South Wales which have the highest levels of human habitation. Based on a comparison of distribution in North Wales in each of the four winters 2007/08-2010/11 and a snapshot in 2021, Blackcap was at least 2.2 times more widely distributed than during the earlier period.

The far greater numbers reported to TC's January 2021 Inquiry in North Wales (254 birds) than were reported from these counties to BirdTrack (6 birds) in the same period indicates the potential of collecting records, for an easily identified species, from wildlife enthusiasts who do not contribute records to county recorders or semi-structured citizen science schemes. This might be considered as a targeted add-on to future Atlas fieldwork.

Estimating the size of the wintering Blackcap population is highly problematic as there are limitations with all the datasets available, and it is clear that numbers in Wales vary considerably between years. We have extrapolated that, conservatively, a minimum of 700-1,000 are present every year, and that at least 2,000 individuals have occurred at least once in the last 10 years. However, these are strict minima. If the ratio of number of Blackcaps in Gardens (70.4%) to Non-gardens (29.6%) in BirdTrack was representative, those recorded by the RSPB Big Garden Birdwatch would only be a part of the picture, and the number across Wales would be almost 30% higher: 373-2,662 birds during January in the years 2004-21 (mean=1,288 individuals). Applying the reporting rate from the RSPB Big Garden Birdwatch to the total number of gardens in Wales, would have produced a far higher estimate. Using the Wales housing stock figures (Welsh Government 2020), and assuming that 88% of households have a garden (the UK average) and that 64% of households feed birds (a figure for England from Davies *et al*. 2012 as we have been unable to find data for Wales), produced a mean population estimate of 42,880 individuals during 2011-21 (15,760-88,855). This, however, does not account for the uneven distribution of Blackcaps across Wales, especially in relation to altitude and distance to coast.

Conclusion

The trend in Blackcap occurrence and abundance has been stable during the last 20 years, with similar reporting rates from BirdTrack, Bird Atlas 2007-11, BTO Garden BirdWatch and, at least until 2016/17, the RSPB Big Garden Birdwatch. The January 2021 Inquiry showed that Blackcap records were more widespread in North Wales than in winters 2007/08-2010/11, with twice as many as in the earlier period. There was variation in the numbers counted per record/garden, to a much greater

degree in the RSPB Big Garden Birdwatch, which showed a seven-fold difference between the highest and lowest counts, than in the BTO Garden Birdwatch, which showed a difference of only 2.25. We suggest that the population of wintering Blackcaps in Wales is a minimum of 2,000 birds, but may be considerably higher.

Acknowledgements

Andrew Stanbury provided the RSPB Big Garden Birdwatch statistics, and Simon Gillings at the British Trust for Ornithology provided tetrad-level and TTV effort data from BirdAtlas 2007-11 and invaluable advice about its use and interpretation. Thanks to Heather Crump for her help with GIS mapping. Our thanks to all the birdwatchers who have submitted records to any of the schemes.

References

Amar, A., Hewson, C.M., Thewlis, R.M., Smith, K.W., Fuller, R.J., Lindsell, J.A., Conway, G., Butler, S. and MacDonald, M.A. 2006. *What's happening to our woodland birds: long-term changes in the populations of woodland birds.* RSPB Research Report 19; BTO Research Report 169.

Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. and Fuller, R.J. (Eds.). 2013. *Bird Atlas 2007-11; the breeding and wintering birds of Britain and Ireland*. Thetford: BTO Books.

Berthold, P. and Helbig, A. 1992. The genetics of bird migration: stimulus, timing and direction. *Ibis* 134 Suppl. 1: 35-40.

Berthold, P. and Pulido, F. 1994. Heritability of migratory activity in a natural bird population. *Proceedings of the Royal Society B*. 257: 311-315.

Boersch-Supan, P.H. and Robinson, R.A. In prep. Integrating structured and unstructured citizen science data to improve wildlife population monitoring.

BTO. 2013. Garden Blackcap Survey. **bto.org/our-science/projects/gbw/about/background/projects/garden_blackcap_survey/key_questions**

Buck, D. 2016. *Gardens and health: implications for policy and practice*. London: The King's Fund.

Davies, Z. G., Fuller, R. A., Dallimer, M., Loram, A. and Gaston, K. J. 2012. Household factors influencing participation in bird feeding activity: a national scale analysis. *PLoS ONE* 7, e39692.

Delmore, K.E., Van Doren, B.M., Conway, G.J., Curk, T., Garrido-Garduño, T., Germain, R.R., Hasselmann, T., Dieter Hiemer, D., van der Jeugd, H.P., Justen, H., Ramos, J.S.L., Maggini, I., Meyer, B.S., Phillips, R.J., Remisiewicz, M., Roberts, G.C.M., Sheldon, B.C., Vogl, W. and Liedvogel, M. 2020. Individual variability and versatility in an eco-evolutionary model of avian migration. *Proceedings of the Royal Society B*. 287: 20201339.

Forrest, H.E. 1919. *A handbook of the vertebrate fauna of North Wales*. London: Witherby.

Glamorgan Bird Club. 2014. **eastglamorganbirdatlas.org.uk**

Harris, S.J., Massimino, D., Balmer, D.E., Eaton, M.A., Noble, D.G., Pearce-Higgins, J.W., Woodcock, P. and Gillings, S. 2020. *The Breeding Bird Survey 2019.* BTO Research Report 726.

Hughes, J., Spence, I.M. and Gillings, S. 2020. Estimating the sizes of breeding populations of birds in Wales. *Birds in Wales* 17(1): 56-67.

Hurford, C. and Lansdown, P. 1995. *Birds of Glamorgan*. Cardiff: National Museum of Wales.

Lack, P.C. 1986. *The atlas of wintering birds in Britain and Ireland*. Calton: T.&A.D. Poyser.

Ozarowska, A. 2012. The origin of Blackcaps *Sylvia atricapilla* wintering in the British Isles. *Ornis Fennica* 89: 254-263.

Plummer, K.E., Siriwardena, G.M., Conway, G.J., Risely, K. and Toms, M.P. 2015. Is supplementary feeding in gardens a driver of evolutionary change in a migratory bird species? *Global Change Biology* 21(12): 4353-4363.

Pritchard, R., Hughes, J., Spence, I.M., Haycock, B. and Brenchley, A. *The Birds of Wales*. Liverpool: Liverpool University Press.

Welsh Government 2020. Dwelling Stock Estimates. **statswales.gov.wales/Catalogue/Housing/Dwelling-Stock-Estimates/dwellingstockestimates-by-year-tenure**

Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D. and Noble, D. 2020. Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 113(2): 69-104.

Photo competition - highly commended
Waiting for lunch (Grey Heron): Tanya Liepins

Preliminary observations of the impact of non-native Pheasants, *Phasianus colchicus*, on the abundance and diversity of invertebrates in upland pasture in mid-Wales.

Jack J. Devlin*[1,2], T. Hefin Jones[1], Robert J. Thomas[1,3]

[1] Cardiff School of Biosciences, Cardiff University, Cardiff, Wales, UK.

[2] University of Kentucky, Lexington, Kentucky, USA

[3] Eco-explore Community Interest Company, ***www.eco-explore.co.uk***

**Corresponding author. email address: jackjdevlin1994@gmail.com*

Crynodeb

Gollyngir degau o filiynau o'r Ffesant *(Phasianus colchicus)* i gefn gwlad Prydain bob blwyddyn ar gyfer saethu hamdden. Nid oes llawer o wybodaeth ar gael am effaith yr adar yma ar fiota brodorol, yn enwedig ar greaduriaid di-asgwrn-cefn. Roedd astudiaethau blaenorol yn edrych ar effaith Ffesantod ar greaduriaid di-asgwrn-cefn un ai o fewn corlannau rhyddhau Ffesantod ar iseldir Lloegr, neu o fewn coedwigoedd a reolid ar gyfer saethu gerllaw'r corlannau. Mae'r astudiaeth bresennol yn edrych ar effaith Ffesantod ar gymunedau creaduriaid di-asgwrn-cefn tu allan i dir a reolir ar gyfer saethu Ffesantod, ar ucheldir Cymru. Gwelwyd cysylltiad negyddol rhwng Ffesantod a niferoedd creaduriaid di-asgwrn-cefn, ond dim cysylltiad gydag amryfaliaeth creaduriaid di-asgwrn-cefn yn gyffredinol. Yn wahanol i astudiaethau blaenorol, ni welwyd unrhyw gysylltiad rhwng mwy o weithgaredd Ffesantod a niferoedd Coleoptera, Araenae, ac Isopoda. Yn gyfyngedig gan niferoedd Ffesantod ac ailadrodd, cyflwynwn y gwaith rhagarweiniol yma fel patrwm ar gyfer astudiaethau pellach i geisio mesur effaith Ffesantod ar gymunedau creaduriaid di-asgwrn-cefn.

Abstract

Tens of millions of Pheasants *(Phasianus colchicus*) are released into the British countryside every year as quarry for recreational shooting. Information on the impact of these birds on native biota, particularly invertebrate communities, is limited. Previous studies have focused on the impacts of pheasants on invertebrates either within pheasant release pens in lowland England, or within woodlands managed for shooting adjacent to such pens. This current study tests for impacts of pheasants on invertebrate communities present outside the boundaries of land managed for pheasant shooting, in the Welsh uplands. We observed a negative association between pheasant activity and overall invertebrate abundance, but no association with overall invertebrate diversity. In contrast with previous studies, no correlation was detected between increased pheasant activity and *Coleoptera, Araenae,* and *Isopoda* abundance. Limited by pheasant numbers and replication, we present this preliminary work as a template on which further studies on the quantification of the impacts of pheasants on invertebrate communities may be based.

Introduction

In the United Kingdom, a feral population of Pheasants (*Phasianus colchicus*) exists at ~ 5.6 million breeding individuals (Musgrove *et al*. 2013; Madden and Perkins 2017). However, this population is supplemented by the mass-release of Pheasants by the game-shooting industry. In 2016, for example, an estimated 47 million individuals were released onto privately-owned shooting estates (Aebischer 2019). Pheasants are omnivorous, and readily consume invertebrates (Robertson 1997). The

abundance and total biomass of these released pheasants (Blackburn and Gaston 2021) means that the total biomass of food needed to sustain them is very large. Previous studies in lowland English woodlands of the ecological impacts of pheasants have reported negative impacts on Coleoptera, Collembola, Lepidoptera and Isopoda, whilst other invertebrate taxa (e.g. Araneae) were minimally affected (Pressland 2010; Neumann *et al*. 2015).

While a limited number of such studies have been carried out on the impacts of pheasants on invertebrates within pheasant release pens, there remains a dearth of studies (and hence, very limited understanding) of the ecological impacts of pheasants on wider ecosystems, beyond the release pens and their immediate surroundings (Neumann *et al*. 2015). This present study tested for the impact of pheasants on invertebrate communities at a farmland site in upland Wales. It was hypothesised that a higher density of pheasants would be associated with lower invertebrate abundance overall, with varying impact on select invertebrate taxa.

Methods

The study took place over a 16-week period, from mid-March to late July 2019 at a farmland site near Pwllgloyw in upland mid-Wales, within a heterogenous landscape and approximately 3 km from a small-scale pheasant shoot (Fig.1). The site was a sub-section of primarily *Juncus effusus/acutiflorus - Galium palustre* rush-pasture with prominent regions of *Filipendula ulmaria* and a section of *Quercus petraea - Betula pubescens - Dicranum majus* W17 woodland (JNCC 2009).

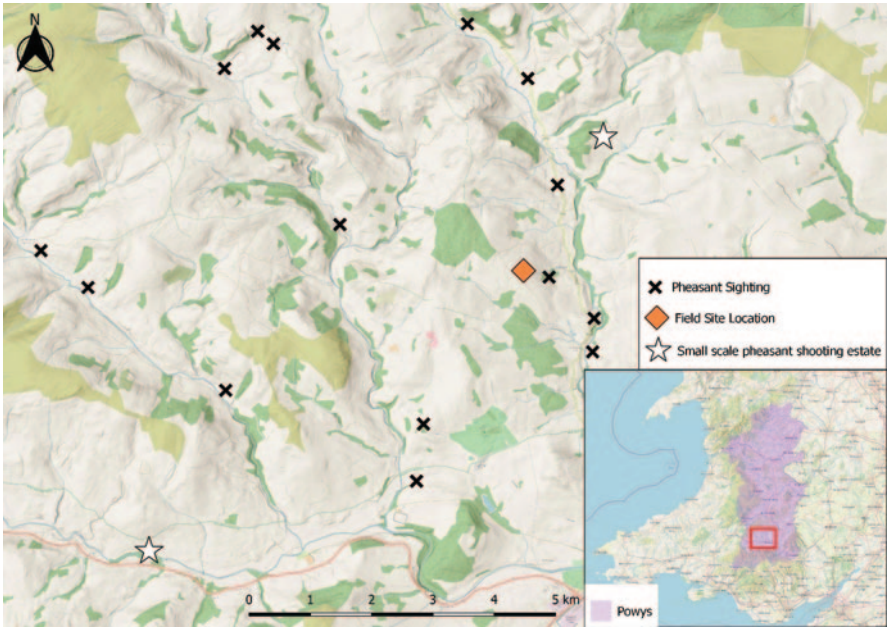


Figure 1. Location of the field site. Mixed-use farmland (pale background), deciduous woodland (dark green) and M.O.D grassland/common land (light green) were the dominant major habitats. Locations of pheasants sighted during the initial site exploration are represented by 'X'. Map created using QGIS v3.4.2 (QGIS Team, 2018).

At the study site, two 25 m x 25 m sampling quadrats were established. One quadrat was constructed with 1.5 m high wooden fence posts positioned every 2 m with chicken wire (25 mm hole diameter) attached from ground level to 1.5 m. This open-topped quadrat acted as an exclusion (control) quadrat to prevent or dissuade pheasants from entering. The unfenced quadrat acted as the treatment quadrat, a 25 m x 25 m area marked out with eight 1.5 m fence posts but without chicken wire, allowing pheasants to move freely into and within it.

A non-lethal approach was used to survey invertebrates at each site, avoiding both bycatch of non-focal taxa (Fischer and Larson 2019) and depletion of target invertebrates. Both quadrats were sampled once weekly on the same day. Three surveying methods were used: (i) Square wooden blocks of approximately 17 cm x 17 cm were used in *lieu* of pitfall traps, following Bowie and Frampton (2004). Each quadrat contained five such blocks. (ii) Net-sweeping was carried out for 15 minutes per quadrat, with effort spatially distributed approximately equally throughout. (iii) Visual encounter surveys were conducted for 15 minutes from a height of 50 cm. Only invertebrates over 3 mm in length were identified, as smaller invertebrates were considered unlikely to be eaten by pheasants. Following Baldi (2003), identification of invertebrates was conducted to family level.

Within each quadrat, various habitat characteristics were assessed during every weekly invertebrate survey: vegetation height (cm), percentage ground-level vegetation cover, number of fungal fruiting bodies, number of individual flowering plants, percentage canopy cover and litter depth (cm). Vegetation was assessed in five 30 cm x 30 cm sampling squares per quadrat. Canopy cover was assessed using photographs taken at ground level, facing directly upwards before being converted to binary (black/white) using ImageJ (Schneider *et al*. 2012), and the corresponding ratio quantified. Ground-level vegetation cover was assessed by allocating cover into one of five categories: 0-25 %, 25-50 %, 50-75 %, >75 %, and > 95 %. Throughout the study, an EasyLog EL-USB-2 data logger was placed between both quadrats to record temperature and humidity at 6-hour intervals.

Each quadrat contained two 12 MP Ltl Acorn 5210A camera traps to capture vertebrate activity; these were placed in opposite corners of each quadrat, avoiding potential biases by avoiding wildlife trails (Kolowski and Forrester 2017). Camera traps were placed at ~ 60 cm height to mitigate the impacts of habitat variation. Cameras captured three pictures whenever trigged, with an interval of one second between images.

Statistical analyses were conducted using the software R Version 3.6.3 (R Core Team 2020), implemented in Studio Version 1.2.502 (RStudio Team 2020) using the packages mgvc (Wood 2019) and ggplot2 (Wickham 2016). For determining the variables that impact invertebrate abundance (the number of invertebrates observed) and invertebrate diversity (the number of invertebrate families observed), four separate Generalised Additive Models (GAM) analyses were used initially. Each analysis contained the smoothed independent variable 'week' and investigated additional groups of independent variables (spatial variables, vertebrate taxa, habitat variables, climate variables). Significant variables retained in these models (following stepwise deletion of non-significant terms using the function anova.gam) were combined into a fifth 'combined' GAM analysis, to allow for the significance of terms to be assessed in the context of the entire biological system investigated (Table 1).

For each GAM analysis with invertebrate abundance as the dependent term, a negative binomial distribution was used, given the over-dispersed nature of the dependent variable (Thomas et al. 2017). For each invertebrate diversity GAM, a Poisson distribution was chosen. The error family and link function for each model was selected based on the lowest AIC value as well as the production

of residual distributions that best satisfied the model assumptions (Thomas et al. 2017). The degree of smoothing (k) was chosen to minimise overdispersion and maximise the difference between the 'effective degrees of freedom' and 'the 'k'-value' (calculated using the gam.check function), within a maximum k-value of 6.

GAM	Dependent terms	Independent terms
Spatial and temporal	Invertebrate abundance/ Invertebrate diversity	Week (smoothed), Quadrat
Spatial, temporal and abiotic model	Invertebrate abundance/ Invertebrate diversity	Week (smoothed), Quadrat, Mean Weekly Temperature (°C), Mean Weekly Humidity, Temperature at Sampling (°C), Humidity at Sampling
Habitat variables	Invertebrate abundance/ Invertebrate diversity	Week (smoothed), Canopy Cover, Litter Depth, Vegetation Height, Ground-Level Vegetation Cover, Number of Flowers, Number of Fungi
Vertebrate variables	Invertebrate abundance/ Invertebrate diversity	Week (smoothed), Count of observations of: Magpie (*Pica pica*), Brown Hare (*Lepus europaeus*), Red Fox (*Vulpes vulpes*), European Rabbit (*Oryctolagus cuniculus*), Raven (*Corvus corax*), Carrion Crow (*Corvus corone*), Jay (*Garrulus glandarius*), Grey Squirrel (*Sciurus carolinensis*), Buzzard (*Buteo buteo*), Pheasant (*Phasianus colchicus*)
Combined model	Invertebrate abundance/ Invertebrate diversity	Week (smoothed), plus significant terms from the above four models, with vertebrate observations analysed in a two-way interaction with quadrat e.g. Pheasant Count x Quadrat

Table 1. The five Generalised Additive Models (GAM) used to investigate impacts on invertebrate diversity and abundance. The significant terms retained in each of the first four models (following stepwise deletion of non-significant terms) were then combined into a fifth, 'combined' model.

The same approach was used to model the impact on abundance of the seven most numerous invertebrate orders (in terms of number of individuals); namely Hymenoptera, Coleoptera, Diptera, Araneae, Hemiptera, Isopoda and Orthoptera. These models allow for direct comparisons with previous studies (Pressland 2010; Neumann *et al*. 2015).

Results

In total, 2,962 invertebrates across 71 families were identified. These were predominantly from three orders: Hymenoptera (n = 956), Araneae (n = 511) and Diptera (n = 506). The control quadrat recorded 1,844 individuals, whereas the treatment quadrat recorded a total of 1,118 individuals.

Pheasant observations across the study period were highly variable, with all pheasants captured on camera trap images within the first nine weeks of the study (Table 2). Pheasant observations were significantly less frequent in the control (exclosure) quadrat than in the treatment quadrat that was

accessible to pheasants (Poisson GLM; z-value = 8.224, d.f. = 1, $p < 0.0001$).

	Images with Pheasants present	
Week	**Control Quadrat**	**Treatment Quadrat**
1	n/a	n/a
2	9	11
3	0	74
4	6	18
5	0	10
6	0	14
7	0	0
8	0	14
9	3	0
10	0	0
Totals	**18**	**141**

Table 2. Numbers of camera trap images with confirmed presence of Pheasants across the 16-week study period.

Following the initial four GAM analyses (Table 1), one variable and three interaction terms were found to be significantly associated with overall invertebrate abundance: Ground-level Vegetation Cover and the interactions "Pheasant Observation x Quadrat", "Magpie Observation x Quadrat" and "Rabbit Observation x Quadrat" (Deviance explained = 74.4%). No significant seasonal variation in invertebrate abundance was observed when these other variables were considered (smoothed effect of Week; edf = 1.941, ref.df = 2.426, Chisq = 3.07, $p = 0.276$).

The specific effects detected were: Vegetation sampling squares with > 95 % ground-level vegetation cover recorded a significantly lower level of invertebrate abundance than lower categories of cover (z-value = -3.516, $p < 0.01$). Invertebrate abundance exhibited a negative association with Pheasant Observation in both quadrats, but this association was only significant in the control quadrat (Fig. 2, z-value = -2.593, $p = 0.010$) and not in the treatment quadrat ($z = -1.682$, $p = 0.092$). Likewise, Magpie Observation was positively correlated with invertebrate abundance (z-value = 3.503, $p < 0.01$), whereas Rabbit Observation was negatively correlated with invertebrate abundance (z-value = -4.289, $p < 0.001$), but such effects were only observed in the control quadrat.

Peak invertebrate abundance in the control quadrat was primarily driven by the presence of a small ants' nest (n = ~200) underneath one sampling block, present between Weeks 3 and 6. Omission of the family Formicidae data resulted in a significant positive correlation with Temperature at Sampling (z-value = 5.475, $p < 0.001$). Significant seasonal variation was also observed when Formicidae was omitted (edf = 4.584, ref.df = 4.913, Chi.sq = 49.77, $p < 0.001$).

When the same statistical approaches were applied to the six selected invertebrate orders, we observed a significant negative correlation between Pheasant Observation and Hymenopteran abundance in both the treatment (z-value = -3.509, $p < 0.001$) and control quadrats (z-value = -3.832, $p < 0.001$). A marginally non-significant negative association between Pheasant Observation and Orthopteran abundance was also observed in the treatment quadrat (z-value = -1.914, $p = 0.056$).

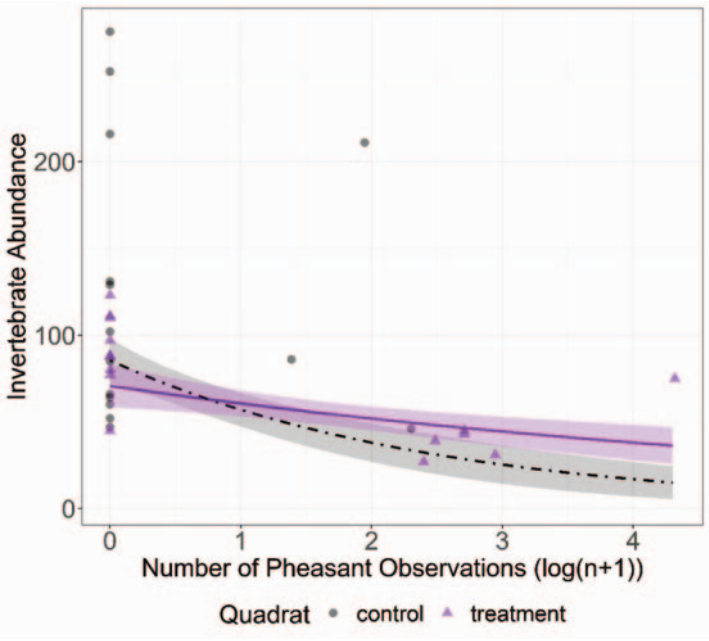


Figure 2. Association between pheasant observations and invertebrate abundance, as predicted by the final GAM analysis. Pheasant observations were significantly negatively associated with invertebrate abundance in the control quadrat (dotted black line, z-value = -2.593, $p < 0.01$) and non-significantly in the treatment quadrat (purple line, z-value = -1.682, $p = 0.09$). The fitted lines show the model's predicted relationship for the middle of the study period (Week 7), with all other parameters in the model set to their mean value. The shaded area shows the standard error (SE) around the fitted relationship.

Pheasant Observation showed no significant associations with the abundances of Diptera, Araneae, Coleoptera or Isopoda (all $p > 0.05$).

Invertebrate diversity presented significant seasonal variation (edf = 2.341, ref.df = 2.877, Chi.sq = 39.76, $p < 0.001$) as well as a correlation with Temperature at Sampling (z-value = 3.651, $p < 0.001$), but not with Pheasant observations ($p > 0.05$).

Discussion

The results of this study suggest that Pheasants may present a negative impact on total abundance of invertebrates in an upland Welsh habitat (Fig.2) and the abundance of particular invertebrate taxa. These apparent effects were detected in the first half of the study period, when Pheasant observations were relatively high.

Previous studies in English lowland woodlands have reported negative impacts of Pheasants foraging on Coleoptera and Isopoda whereas other invertebrate taxa (e.g. Araneae) were minimally affected (Pressland 2010; Neumann *et al*. 2015). In the present study, similar results were not observed for Araneae, Coleoptera and Isopoda. Negative associations between the variable Pheasant Observation and Order-level abundance were observed for Hymenoptera (significant) and possibly for Orthoptera

(marginally non-significant).

Exactly how Pheasants modify invertebrate communities, remains unclear, but at the relatively low abundances of Pheasants observed in the present study, modification through consumption of invertebrates and disturbance of vegetation appear most likely. The provisional results presented here suggest that Pheasant foraging may impact different invertebrate taxa to different extents. We present this study as a template from which future work may be conducted. Establishing further sampling quadrats across mid-Wales would allow for a more robust quantification of the impacts of Pheasants upon invertebrate communities.

Acknowledgments

We thank Dai and Ruth Thomas, for their kind permission to use their land at Pwllgloyw, and Jonathan Jones for his assistance in setting up the quadrats.

References

Baldi, A. 2003. Using higher taxa as surrogates of species richness: a study based on 3,700 Coleoptera, Diptera, and Acari species in Central-Hungarian reserves. *Basic Applied Ecology* 4: 589–593.

Blackburn, T.M. and Gaston, K.J. 2021. Contribution of non-native galliforms to annual variation in biomass of British birds. *Biological Invasions* 23: 1549–1562.

Bowie, M.H. and Frampton, C.M. 2004. A practical technique for non-destructive monitoring of soil surface invertebrates for ecological restoration programmes. *Ecological Management and Restoration* 5: 34–42.

Fischer, B. and Larson, B.M.H. 2019. Collecting insects to conserve them: a call for ethical caution. *Insect Conservation and Diversity* 12: 173-182.

Joint Nature Conservation Committee. 2009. *The National Vegetation Classification (NVC)* **http://jncc.defra.gov.uk/page-4259** [Accessed: 07/11/18].

Kolowski, J.M. and Forrester, T.D. 2017. Camera trap placement and the potential for bias due to trails and other features. *PLoS ONE* 12: 1–20.

Madden, J.R. and Perkins, S.E. 2017. Why did the pheasant cross the road? Long-term road mortality patterns in relation to management changes. *Royal Society Open Science* 4: 170617.

Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, D. 2013. Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 106: 64–100.

Neumann, J.L., Holloway, G.J., Sage, R.B. and Hoodless, A.N. 2015. Releasing of pheasants for shooting in the UK alters woodland invertebrate communities. *Biological Conservation* 191: 50–59.

Pressland, C. 2010. *The impact of releasing pheasants for shooting on invertebrates in British woodlands*. Unpublished PhD Dissertation, University of Bristol.

QGIS Team. 2018. *QGIS: Geographic Information System*. Open Source Geospatial Foundation. Available at: **http://qgis.osgeo.org**

R Core Team. 2020. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. Available at: **https://www.R-project.org/**

Robertson, P. 1997. *A Natural History of the Pheasant*. Shrewsbury: Swan Hill Press.

RStudio Team. 2020. *RStudio: Integrated Development for R*. Boston MA: RStudio, Inc. Available at: **http://www.rstudio.com/**

Schneider, C.A., Rasband, W.S. and Eliceiri, K.W. 2012. NIH Image to ImageJ: 25 years of image analysis. *Nature Methods* 9: 671-675.

Thomas, R.J., Lello, J., Medeiros, M., Pollard, A., Robinson, P., Seward, A., Smith, J., Vafidis, J. and Vaughan, I. 2017. *Data Analysis with R Statistical Software: A guidebook for scientists*. Caerphilly: Eco-explore.

Wickham, H. 2016. *ggplot2: Elegant graphics for data analysis*. Available at: **https://cran.r-project.org/web/packages/ggplot2/index.html**

Wood, S.N. 2019. *mgcv: Mixed GAM computation vehicle with automatic smoothness estimation.* Available at: **https://cran.r-project.org/web/packages/mgcv/index.html**

Photo competition - highly commended
Stormy Gannet: Steve Stansfield

A Pied Flycatcher – one of many

Bob Harris
3 Mossleigh, Whixall, Whitchurch, Shropshire SY13 2SA
drbobharris@gmail.com

Introduction

Ringing, the art of individually marking a bird with a small metal ring has come a long way since its inception (BTO1). Since that time techniques (colour-rings, leg-flags, wing-tags etc) and technologies (PIT tags, light-level geolocators, satellite-tracking etc) have developed giving us far more insight into the flight and plight of selected individuals (Lopez-Lopez 2016).

All of these methodologies have served to make individuals more 'visible', be that optically or electronically, and that visibility has given rise to some amazing findings e.g. Red-necked Phalarope *Phalaropus lobatus* from Scotland to Peru (Smith *et al*. 2014), Willow Warbler *Phylloscopus trochilus* from east Russia to east Africa (Sokolovskis *et al*. 2018), Wheatears *Oenanthe oenanthe* taking one-three months to migrate *c.*15,000km, one-way (Bairlein *et al.* 2012) and the migration patterns of Scottish Ring Ouzels *Turdus torquatus* wintering in the Algerian Atlas mountains (Sim *et al*. 2015).

The new technologies are (still) expensive and, for smaller birds, it usually requires the individual to be recaptured in order to download data. Techniques are less expensive but repeat observations are very much dependent on the lifestyle of the bird concerned – it is easier to re-sight a Black-headed Gull *Chroicocephalus ridibundus* than a House Martin *Delichon urbicum* – and the number of observers in the field. Metal rings are still the technique of choice - even if a new technology or technique is used the bird still has a metal ring fitted. They are cheap and easily fitted but the big downside is that, relatively speaking, few of the birds so marked are ever encountered again; such is the turnover of birds.

Alongside these techniques and technologies standardized field methodologies have been introduced and developed to extract information from ringed birds. The British Trust for Ornithology Retrapping Adults for Survival (RAS) study (BTO2) – capturing/resighting as many adults as possible in a set population annually - has been designed to provide information on changing population dynamics that could not be derived in any other way.

The Pied Flycatcher *Ficedula hypoleuca* is a small summer migrant to our shores that has benefitted from deployment of some of this new technology. Janne Ouwehand *et al*. (2016a) using light-level geolocators has been able to show the autumn migration route of European populations of flycatchers, their staging and movement in wintering quarters in Guinea, Liberia and Ghana, and the route of their spring migration north; which is further east than their arrival route in Africa. Further they were able to demonstrate that, on departure, flycatchers make a continuous first-flight of *c.*40hours, at height (to avoid high surface desert temperatures) in order to cross the Sahara in one movement (Ouwehand *et al*. 2016b).

This flycatcher lends itself to further scientific study because it will readily adopt nest-boxes, in preference to natural sites, for nesting (Lundberg and Alatalo 1992). Furthermore, if successful in breeding it demonstrates a high degree of site fidelity (Nyholm 2019, Sokolov 2000). So, positioning nest boxes in suitable habitat has the potential to generate a population of flycatchers for detailed study. Although not as 'sexy' as other techniques it does have the ability to reveal aspects of the

birds' life currently not obtainable by other methods.

According to the British Trust for Ornithology website (BTO3) 10,982 Pied Flycatcher pulli were ringed in 2010. One of these was X062920, ringed near Llanarmon-yn-Iâl in north Wales. This is his story.

X062920

Figure 1. X062920 in 2019.

X062920 (Fig.1) arose from a clutch of eight eggs in June 2010. He and four siblings were ringed as 12-day old chicks and survived to fledging. He was not caught anywhere in 2011, which is not unusual, as 26-69% of males do not breed in their first year (Oorwijn 2016). His first recapture was in July the following year. However this was not at Llanarmon but at another site in north Wales, Glyn Arthur, 9km to the north-west.

Glyn Arthur is a small side valley of the Vale of Clwyd and is part of the Clwdian Range AONB. It runs to *c.*35hectares with botanical evidence suggesting it was once ancient woodland. It consists of mature Pedunculate Oak *Quercus robur* with stands of Beech *Fagus sylvatica* trees and an unmanaged understory. The site splits itself into three identifiable habitats – north and south facing slopes and a spring fed, Alder *Alnus glutinosa* lined stream, that runs between the two slopes. Areas outside woodland and along the stream are managed for sheep grazing. Data collected over the years as part of a RAS study indicated that breeding by all species is earlier on the south-facing slope but that overall productivity between the two slopes is similar. Over the period 1986-2019 there have been fifteen exchanges of birds between Llanarmon and Glyn Arthur.

Throughout the whole of his breeding life X062920 nested on the north-facing slope of Glyn Arthur using six different nest boxes all within a footprint of <0.6 hectare (Fig.2). In his first known breeding year, 2012 at two years old, he paired with a new 2nd year female, who laid eight eggs; eight hatched

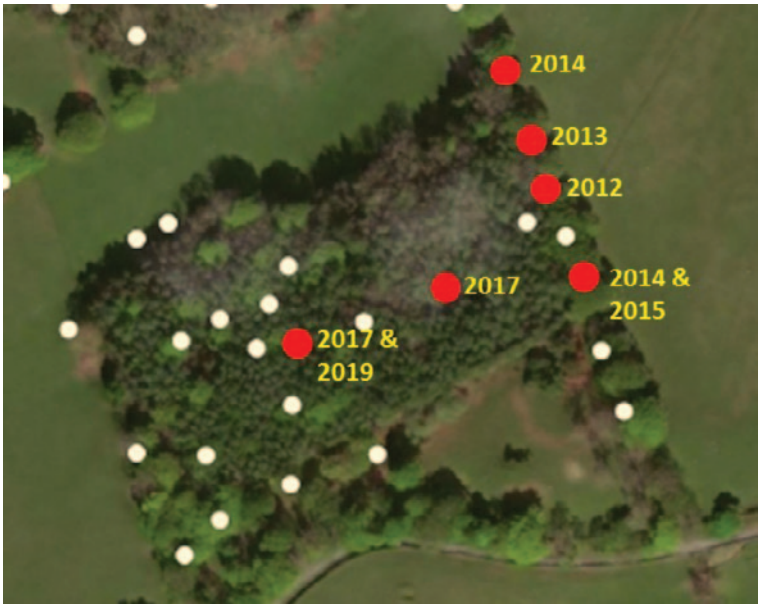


Figure 2. Nestbox use by X062920. Red circles= boxes used by X062920, with year of use; white circles=additional boxes available. North is perpendicular within the figure. All surrounding fields were utilized for sheep grazing.

and all survived until fledging. The following year he paired with another 2nd year female. With X062920 in 2013 she laid seven eggs and subsequently six hatched which fledged. The relative late first egg date of this clutch (22 May), lends the suggestion that this was a polygamous pairing with a female from a first failed nesting attempt. There was another pairing in a box on the north slope in 2013. The male from this pairing was not caught and, given we know that X062920 restricted his breeding area, it is possible that the female of this pair was his primary nesting female that year.

On his return in 2014, X062920 was definitely polygamous. His primary female, L638396 >2 years old (who bred successfully on site in 2013 and 2015) laid seven eggs starting on 5 May - with all going on to fledge. His secondary female had a first egg date of 11 May, laid seven, hatched six and fledged five, which is probably better than would be expected for a secondary pairing; the two nest boxes involved were 94m apart.

In 2015 he had a much more conventional year, he paired with a 2nd year female - she laid eight eggs and they raised eight young. He was not caught in 2016. There were only two pairs within the wood on the north-slope that year and he was not the male from either. It is quite possible that he may have been on site and not bred, or used a natural site which was not discovered. It is unlikely that he was not on site as he was back again the following year.

His arrival in 2017 started somewhat usually. In two boxes, 68.2m apart, two females were caught, separately, in each box. One, the subsequently labeled primary female, was a 2nd year female with a first egg date of 4 May; the other, an older bird who had nested on site the previous year had a first egg date of 12 May. Both pairings laid seven eggs and fledged seven young. It is possible or plausible that as both females had been caught in both nest boxes, as had the male, that these broods may

have had 1.5x adults feeding each brood rather than a mix of two for one and one for the other, as demonstrated by their equal success. The pairing of X062920 with the older secondary female was the only pairing that produced a recaptured offspring - all of the others having never been heard of again. This individual, caught as a breeding female the following year, was not at Glyn Arthur but back at Llanarmon where her father arose.

2018 was a repeat of 2016. X062920 was not trapped at any active nests on the north slope although there was one nest where the male was not seen or heard. This might have been him or, like 2016, he could have nested in a natural hole on site. Again, it could be argued that he was present for he reappeared to be captured in 2019. This year he paired with a new female to the site (>2 years old) whereby they raised three young from seven eggs. X062920 was trapped on the nest on 2 and 11 June, the latter when he would have been 8 days short of the national longevity record for a Pied Flycatcher (which is 9 years and seven days).

X062920 paired at least ten times (if we assume he bred in 2016 and 2018 but not 2011) with at least eight known females who demonstrated an almost equal division on age; four were at least two years old and three in their first possible breeding year (one was of undetermined age at the time of breeding). Of these breeding attempts two, and possibly three pairings were polygamous. This, then, puts his rate of polygamy at 20-30% which is at the top end of the accepted range of 2-23% (Møller 1986). In all of his recorded pairings, X062920 helped raise 51 chicks of which only one was (re)captured – as a breeding female in her first year back at the site where her father was hatched.

If we consider the output of X062920 with his mates annually over the whole of his life and compare it with the site average for Glyn Arthur some interesting features emerge (Table 1). For each year the first egg date (FED) for the female with X062920 is nearly always later than the site average, which is not unexpected for a pair nesting on the north-facing slope. The date and difference for 2013 has already been explained as a possible second laying event. What does appear to be notable

	Site data			X062920			
Year	**Av FED**	**Av CS**	**Av Fldg**	**FED**	**ΔFED**	**CS**	**Fldg**
2012	37	6.1	5.1	46	9	8	8
2013	32	6.6	4.4	52	20	7	6
2014	36	6.5	4.3	35	1	7	7
2014	36	6.5	4.3	41	5	7	5
2015	38	6.6	4.2	40	2	8	8
2016	25	6.7	4.7				
2017	30	5.9	4.0	39	9	7	7
2018							
2019	34	5.1	4.0	32	-2	7	3

Table 1. Reproductive outputs of a Pied Flycatcher, X062920, compared to the site average for Glyn Arthur. Av = average, FED = first egg date, CS = clutch size, Fldg = Fledged, Δ = difference. 1 April = day 1.

however is that X062920 and his mate of the year always produced larger clutches and fledged more young than the yearly site averages. This almost certainly is a marker of his fitness and desirability as a mate.

So, simple ringing with a single metal ring has, in this context, given us an interesting history on a single male Pied Flycatcher. His breeding success in 2012 was sufficient for him to return to the site year after year producing offspring in excess of the site averages using a small number of boxes over a very small land footprint. He never bred with the same female twice even though at least three of them returned to the north slope to breed in successive years. He almost certainly exceeded the longevity record for Pied Flycatcher. Repeated observation attempts around the term of the record were unsuccessful. Unfortunately Covid-19 put paid to discovering him in 2020 and his likelihood of appearing in 2021 is slim.

Acknowledgements

To the Williams family of Glyn Arthur for their continued support of access to their land in order to undertake this study.

References

Bairlein, F., Norris, D.R., Nagel, R., Bulte, M., Voight, C.C., Fox, J.W., Hussell, D.J.T. and Schmaljohann, H. 2012. Cross-hemisphere migration of a 25g songbird. *Biology Letters* 8:505-507.

BTO1. **www.bto.org/our-science/projects/ringing/about-ringing/history-ringing** Accessed March 2021.

BTO2. **www.bto.org/our-science/projects/ringing/surveys/ras** Accessed March 2021.

BTO3. **https://app.bto.org/ring/countyrec/results2010/ringBI2010.htm** Accessed March 2021.

Lundberg, A. and Alatalo, R.V. 1992. *The Pied Flycatcher.* London: T.&A.D. Poyser.

Lopez-Lopez, P. 2016. Individual-based tracking systems in ornithology: Welcome to the era of big data. *Ardeola* 63: 103-136.

Møller, A.P. 1986. Mating systems among European passerines: a review. *Ibis* 128: 234-250.

Nyholm, N.E. 2019. Return rates of nest box breeding Pied Flycatcher *Ficedula hypoleuca* to their breeding site in subalpine birch forest in Swedish Lapland 1965-2018. *Ornis Svecica* 29: 53-68.

Oortwijn, T. 2016. *Competition and age at first breeding in flycatchers*. MSc thesis. Netherlands Institute for Sea Research.

Ouwehand, J., Ahola, M.P., Ausems, A.N.M.A., Bridge, E.S., Burgess, M., Hahn, S., Hewson, C.M., Klaassen, G., Laaksonen, T., Lampe, H.M., Velmala W. and Both, C. 2016a. Light-level geolocators reveal migratory connectivity in European populations of Pied Flycatcher *Ficedula hypoleuca*. *Journal of Avian Biology* 47: 69-83.

Ouwehand, J. and Both, C. 2016b. Alternate non-stop migration strategies of Pied Flycatchers to cross the Saharan desert. *Biology Letters* 12: p.20151060

Sim, I.M.W., Green, M., Rebecca, G.W. and Burgess, M.D. 2015. Geolocators reveal new insights into Ring Ouzel Turdus torquatus migration routes and non-breeding areas. *Bird Study* 62: 561-565.

Smith, M., Bolton, M., Okill, J.D., Summers, R.W., Ellis, P., Liechti, F. and Wilson, J.D. 2014. Geolocator tagging reveals Pacific migration of Red-necked Phalarope *Phalaropus lobatus* breeding in Scotland. *Ibis* 156: 870-873.

Sokolov, L. 2000. Philopatry, dispersal and population structure of passerines on the Courish Spit of the Baltic Sea. *Die Vogelwarte* 40: 302-314.

Sokolovskis, K., Bianco, G., Willemoes, M., Solovyeva, D., Bensch, S. and Akesson, S. 2018. Ten grams and 13,000km on the wing – route choice in Willow Warbler *Phylloscopus trochilus yakutensis* migration from Far East Russia to East Africa. *Movement Ecology* 6: 1-10.

Montagu's Harriers in Pembrokeshire and an historic photograph

David Saunders
School House, 75 Laws Street, Pembroke Dock, SA72 6DQ
saundersswift@gmail.com

Introduction

The earliest Pembrokeshire breeding record of the Montagu's Harrier *Circus pygargus* indeed for Wales is that from Leweston about eight miles north of Haverfordwest Mathew (1894) reporting: "The late Mr. Fortune found a nest of this Harrier close to his residence at Leweston, July 2, 1854, containing an egg and three young birds in down. He succeeded in obtaining the two old birds and mounted them with the young, and the case is now to be seen in the Museum at Tenby, and is a beautiful example of his skill in taxidermy. The egg was presented to the collection by the Rev. C.M. Phelps. This is the only instance of Montagu's Harrier in the county of which we can find a record, but it must doubtless have been both shot and trapped without recognition". A recent inquiry with Tenby Museum elucidated the information that the specimens were disposed of some time ago, presumably because they had deteriorated beyond repair.

Over half a century was to pass before another sighting of a Montagu's Harrier. Henry W Evans of Solva, a keen ornithologist and collector, noted in his copy of Mathew (1894) how he had purchased for 10 shillings a beautiful specimen which he then stuffed. This had been shot by Ben Thomas, tailor of Solva, on 11 March 1911 at Bwlchmawr just north-east of Solva (Whitelock 2010).

The next record was a female Montagu's Harrier and four eggs taken in 1914 though no details are available (Lovegrove *et al*. 1994). Again tragically without details, Lockley (1961) reported that Montagu's Harriers had bred in many years between Tenby Marsh and Freshwater West.

Lovegrove *et al.* (1994) drew attention to the egg collection of the indefatigable, and clearly a menace, J.H. Howell of Solva now in the National Museum of Wales; eight clutches of Montagu's Harrier eggs, no less, between 1926 and 1939, taken in Pembrokeshire. Despite being a 'terrible' collector he was described by Captain H.G. Gilbert as the only man who can save Montagu's Harrier from extinction in the county (Lemon 1936). This was never put to the test as in 1940 Howell turned his attention to the Peregrine *Falco peregrinus* substituting dummy eggs for real eggs at eyries on the Pembrokeshire coast in an effort to reduce predation on message-carrying homing pigeons (Howells unpublished mss).

Missing from previous publications are the observations of Bertram Lloyd, a resident of Hertfordshire, known to his friends as 'Wolf' on account of his long, easy and rapid gait (Benson 1944) who made a number of visits to Pembrokeshire, including the islands, during the 1920s and 1930s. One of his contacts was the Reverend Alfred Saunders Jeremiah, priest in charge of St Michaels and All Angels Church, Castlemartin, where a memorial window to Jeremiah depicts the birds of which he was particularly fond: Raven *Corvus corax*, Chough *Pyrrhocorax pyrrhocorax*, Barn Owl *Tyto alba* and Montagu's Harrier (Hardy 2019). Together they visited the nests of Montagu's Harriers in Castlemartin Corse, the valley extending eastwards from the sea at Freshwater West.

In 1930 the nest was 'near the middle of a big quiet marsh, as we approached, the female – looking

a very dirty brown flew off the nest at about 5yds from us. She flew silently up the marsh, perhaps joining the male whose pet perch is a small fence-post about half-a-mile away'. On 8 July the nest contained four eggs, the female returning pretty soon 'slinking low over the marsh so that we didn't sight her'. The following day Jeremiah and Lloyd discovered to their distress that the nest had been robbed by humans.

The same patch of marshy ground was used in 1931. Two of the four young were lost as the result of two days' heavy rain in late July, while in 1934, Jeremiah reported that three young all got off safely (Lloyd Diaries). Jeremiah died the following year. No more seems to be known about the Montagu's Harriers at this location, though Lloyd tantalizingly notes that he had seen nests 'within a short furlong' on two previous occasions.

Montagu's Harriers probably continued to nest on the marshlands and wet heaths north-east of St David's after 1939, though not until 1954 was there any record, when in that year D. Richard Evans located two nests each containing three young which all fledged even though a single male serviced both females. From then on breeding was recorded or strongly suspected at this location and at least two others until 1962, following which adult birds were seen in other suitable habitats with breeding possibly taking place for the final time in 1968 and 1970 (Lovegrove *et al.* 1994).

The historic photograph

In February 1978 Colonel Morrey Salmon submitted to The Zoological Photographic Club a photograph of a Montagu's Harrier with three young taken on 7 July 1935 on the rough shoot near to St David's, run by Captains (Barmy) Gilbert and J.H. Howell. In his note accompanying the photograph Salmon describes how: "…they told their keeper, a ruffian named Lamb, with an immense capacity for beer, to see that it came to no harm and the young flew alright. The nest was in a small bog of only a few acres extent much overgrown with tall, rank gorse, sallow etc and it was less than 100 yards into the bog over the churchyard wall on the outskirts of a small village. G.C.S. Ingram and I shared the hide with Arthur Brook who was then still collaborating photographically with H.A. Gilbert".

Among the fifteen comments made by Photographic Club members regarding the photograph is one from Harold Platt, an enormously influential figure in the history of the Club, whose membership lasted some sixty-three years until his death in 2000, and second only to that of Morrey Salmon who was a member for seventy-three years. It reads: "I went down on my own in 1937 (A.B. was then in Bristol) after Lamb wrote me to say that the Monty had hatched. A.B. had warned me about Lamb and his drinking exploits but I was lucky that he was in bed with lumbago

and his son, a red-haired youth, showed me the nest. There was one young only and after questioning Lamb of the size of the clutch he said that it had laid six eggs but he took four away as the bird 'couldn't cover them'. The other four were no doubt sold as a clutch. The morning I went in the hide a thick sea fog had descended on the area and all I got was a very inferior shot of the male. The fog stayed for several days and I had to return home disappointed".

As to the location, from the description by Morrey Salmon the most likely seems to be Llandeloy. Although part of the bog is now reclaimed, some still remains within the Ministry of Defence land of the former Brawdy airfield, and would, before the Second World War, have been excellent Montagu's Harrier territory.

Acknowledgements

More years ago than I care to remember, Peter Howlett, Curator of Vertebrates at the National Museum of Wales, drew my attention to the Morrey Salmon collection of photographs held in the Museum, that shown here just one of many which catch the eye. Stephen Evans, Botanical Recorder for Pembrokeshire, having an intimate knowledge of the heaths and rough pastures of the St David's Peninsula suggested Llandeloy as the location of the photograph. John Tinning, of the Zoological Photographic Club, provided information concerning Harold Platt who also photographed Montagu's Harriers in Pembrokeshire while Eloise Morgan of the Tenby Museum sadly broke the news that the Leweston Montagu's Harriers have long been destroyed. Better news from Linda Asman of the Pembroke and Monkton Historical Society, who drew my attention to the memorial window in Castlemartin Church and whose book includes a biography of the Reverend Jeremiah.

References

Benson, R.B. 1944. Bertram Lloyd 1881-1944 Obituary. *Transactions of the Hertfordshire Natural History Society* 22: 57-59.

Hardy, M. 2019. Reverend Alfred Saunders Jeremiah and Olive Jeremiah. pp. 142-145 Aman, L. *Pembroke Remembers*. Pembroke and Monkton Local History Society.

Howell, J.H. 1983. *Howell of Trewellwell*. Unpublished biography held in the Pembrokeshire Archives.

Lemon, M.I. 1936. *Report on intinerary in Wales October 24th to 28th 1936 to investigate the various and conflicting accounts which have been received of the conflagration on Grassholm on August 27th 1936.* Unpublished 13-page report in RSPB archives.

Lloyd, B. 1930. Pembrokeshire Journals unpublished held in the National Museum of Wales.

Lloyd, B. 1931. Pembrokeshire Journals unpublished held in the National Museum of Wales.

Lockley, R.M. 1961. Birds of the south-western peninsula of Wales. *Nature in Wales* 7: 124-133.

Lovegrove, R., William, G. and Williams, I. 1994. *Birds in Wales*. London: T.&A.D. Poyser.

Mathew, Rev. M.A. 1894. *The Birds of Pembrokeshire and its islands.* London: R.H. Porter.

Salmon, M. 1977. Description of and comments received regarding the photograph of a Montagu's Harrier and three young in Pembrokeshire. The Zoological Photographic Club.

Whitelock, M. 2010. The bird man of Solva. *Pembrokeshire Life* January page 27.

A tribute to Graham Rees

It is with considerable sadness that the Pembrokeshire Bird Group learned that Graham Rees 'Mr Strumble' had died on 22 June 2021 at the age of 84. Graham's name will always be synonymous with Strumble Head, as he spent many hours, days and years patiently observing and recording the remarkable avian passage that occurs there. His observations of Common Scoter *Melanitta nigra* passing Strumble, for example, provided useful pointers to the timing and numbers of these birds likely to be present in Carmarthen Bay.

Graham, a native of Pembrokeshire, spent his formative years and his birding apprenticeship in Hampshire. His family moved there (when he was aged about two years old) just prior to the start of the 2nd World War. By about 1948/49 Graham was attending Portsmouth's Hilsea Technical School, where Eddie Wiseman, another budding birder, first became acquainted with him. Graham apparently learned some of his early birding skills cycling around the New Forest, but also by visits to Farlington Marshes and around Langstone Harbour where, by the early 1950s, he was spending quite a lot of time. Graham (Taff as he was referred to by other local birding friends) became a member of the so-called Portsmouth Group (Wiseman 2009). This group of like-minded enthusiastic bird watchers were true innovators. Through their coordinated efforts, they developed a systematic approach to study and document what they found in the area, contributing much valuable information to the Hampshire Bird Reports at that time. Eddie Wiseman recalls how Graham's ability at bird identification taught him so much in his early Portsmouth Group days. Graham also introduced him to seawatching, which was to become one of Graham's passions (some might say an obsession) at Strumble Head when he returned to Pembrokeshire in 1974, having spent five years working in Scotland.

Some years prior to that, like others of his generation, he had undertaken National Service in the Army, for a time based at Catterick where he soon became acquainted with the birds of north Yorkshire and then in North Africa. Graham never spoke much about his employment as a civilian, but he worked at Ministry of Defence establishments, including the Royal Naval Armaments Depot, at Newton Noyes, near Milford Haven.

On his return to Pembrokeshire, Graham soon became actively involved with the county Wildlife Trust. Between 1981 and 2007 he was Bird Recorder for Pembrokeshire (VC 45) and editor of the Pembrokeshire Bird Report, positions he shared for many years during this period with the late Jack Donovan. From around 1981 to the early 2000s, he was also the Representative for Pembrokeshire of the British Trust for Ornithology – actively involved with organising and conducting numerous national and local bird surveys. Graham was also a founder member of the Welsh Ornithological Society, being its chairman in 1990 and 1991. He was a serving member and secretary for the Welsh Rarities Advisory Group (WRAG) during this period but stepped away when the Welsh Rarities Panel (WRP) (now Welsh Birds Rarities Committee) superseded it. It is probably fair to say that Graham and Jack Donovan were not entirely happy with the establishment of the WRP. In an editorial for the 1993 Pembrokeshire Bird Report, Graham registered his main concerns: that the findings of the WRP were now mandatory rather than advisory; he also thought (his words) that "an opportunity had been lost to relate observational detail to the degree of difficulty of identification". Despite the differences of opinion with WOS at that time about how records of Welsh and county rarities should be assessed, he and Jack always made Pembrokeshire bird records available for annual Welsh Bird Reports.

As well as being a trustee for many years of the county Wildlife Trust, Graham also served on various

Trust committees. He was a long-serving member of the Skomer and Skokholm Islands management committee during the 1980s and 1990s and of the somewhat grandly titled Pembrokeshire Organising Committee for Ornithological Research (POCOR) - being its secretary. He was also a key member of its shorter-lived successor (Pembrokeshire Ornithological Research Committee (PORC). Graham was the main driving force in the organisation of two county-wide breeding bird surveys. The first (1984-88), formed the major component of a new county avifauna *Birds of Pembrokeshire* published in 1994, for which he was joint author with Jack Donovan. For this atlas Graham not only contributed a significant number of tetrad records for it, but also produced all the species distribution maps by hand - no digital mapping in those days! About 20 years later he wrote most of the species accounts for the second county atlas (*Atlas of Breeding Birds in Pembrokeshire 2003-07*), published in 2009 by the Pembrokeshire Bird Group. Earlier, in 1993, Graham had played a significant role in the establishment of the Bird Group as an important contributory section of the Wildlife Trust.

In his role as a long-serving chairman of the Bird Group committee, Graham (aided by various local birders) had responsibility not only as editor of the annual Bird Report but for the organisation and management of an increasingly popular annual Pembrokeshire Bird Watchers' conference, plus other ornithologically-related indoor and outdoor events in the county and beyond. Graham undertook all these tasks in his usual quiet (some might say dour) manner, but with considerable relish and dexterity nonetheless, over many years.

Graham may not have been an exponent of the dawning digital photography era, but he produced many fine sketches and paintings, illustrating the details of birds he had observed in various parts of the world. I well remember a talk he gave at one of the annual conferences about a birding trip he and others had made to Hongkong. The presentation was beautifully illustrated with Graham's water-colours of species highlights – no actual bird photos were needed, photographic slides of his images said it all.

Although retiring as County Recorder in 2007, Graham was keen to embrace the computer age and wanted to make sure that county records were accessible for others to use. He was incredibly supportive in the production of the Bird Group's on-line "*Pembrokeshire Avifauna*" and made major contributions to it - delving into his notebooks and diaries etc to update accounts about species migration patterns and so on. These included analyses of seabird passage records for several species observed from his beloved 'Strumble'. Graham's keen interest in seawatching and his knowledge of the weather systems that help to create these exciting offshore spectacles are evident in a chapter he wrote for *Birds in Wales* (1994): Chapter 8, The offshore waters of Wales pp.29-32.

By 1992, Graham had already logged 3,946 hours of seawatching from the old War Department look-out building at Strumble Head, which was almost his second home! He wrote an excellent article about the Strumble Head story, for the on-line *Pembrokeshire Avifauna* (see references). This was based on a presentation that he gave at the 2005 Pembrokeshire Bird Conference. When he was at Strumble and elsewhere, Graham would readily share his knowledge with fellow birders, helping beginners or visiting birders by answering queries, explaining identification features or pointing out passing birds.

His very understanding wife, Linda (who sadly died 14 months earlier), seems to have summed up Graham very well and rather whimsically. Jon Green, who succeeded Graham as County Recorder, recalls that she apparently wrote in his desk diary on one occasion: on Christmas Day + Boxing Day "STAY AT HOME"; for the 27th, she wrote: "BACK TO NORMAL"!

In 2012, Graham was a well-deserved a recipient of a WOS Lifetime Achievement Award, in recognition of his outstanding contributions to ornithology in Wales.

Graham receiving his Lifetime Achievement Award from Iolo Williams, WOS President, Myddfai, November 2016.

In 2013, he was appointed as a Vice President of the Wildlife Trust; a certificate to mark the occasion was presented by the late Derek Moore at that year's Pembrokeshire Bird Conference (Derek having been Director of the Wildlife Trust South and West Wales and Chairman of WOS). Graham's appointment was greeted by a great deal of support and enthusiasm from long standing Trust members and in particular the birding community in Pembrokeshire, not least because he was one of the driving forces behind the formation of the Pembrokeshire Bird Group and the Welsh Ornithological Society, as well as his service on multitude of other ornithological groups and committees.

Having amassed a huge collection of around 40 lever arch files, all stuffed full with thousands of county bird records, dating back to the early 20th century, Graham was concerned that these valuable paper records were in danger of deteriorating and becoming illegible. In their current state they were also not in an easily accessible format for further scrutiny. He approached the Pembrokeshire Bird Group committee in 2015 to see how best these records could be preserved and made available for others to access in future. That lead to a project involving myself and the West Wales Biodiversity Information Centre (WWBIC) in the scanning of all the records to create individual species PDF files as an initial archive of his collection. Copies are held by both WWBIC and the Bird Group. Graham was also keen to make sure that his own notebook records from Strumble Head and elsewhere in Pembrokeshire were made available for further study. He spent many hours transferring these to BirdTrack which, despite his initial headache with computer databases, he was determined to complete.

Hopefully, Graham's legacy – a lifetime of diligently recording and translating what he saw - will enthuse and inspire others to do the same.

Bob Haycock (Chairman, Pembrokeshire Bird Group)
With thanks to David Saunders, Eddie Wiseman, Cliff Benson and Lizzie Wilberforce for some of the

earlier information.

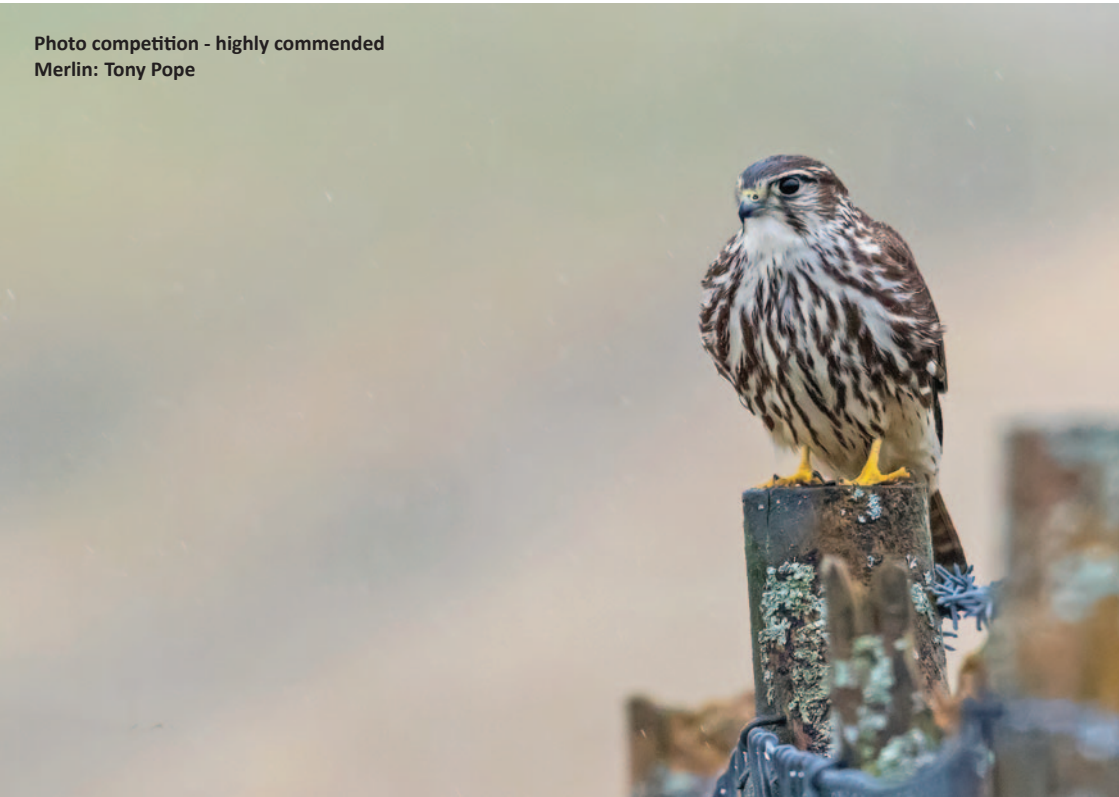
References

Rees, G. H. 2005. Strumble Head – the story to 2005.

https://pembsavifauna.co.uk/2005/12/28/strumble-head-the-story-to-2005/

Wiseman, E. 2009. The Portsmouth Group. *British Birds* 102: 132–136.

Photo competition - highly commended
Merlin: Tony Pope



A gallery from the first WOS photo competition

In the autumn of 2020 and the first couple of months of 2021, WOS held its first ever photo competition. This generated an impressive 166 entries, featuring 86 different species and was split into three categories: a main section, a junior section for under 16s and a humorous section, open to all. All photographs had to be taken between 1 January 2020 and 27 February 2021 in Wales.

There were many superb entries: so many that a lot of great photos did not make the final shortlists from our three judges. But there was little argument about Iolo Williams' choice of our final overall winner – a lovely daytime shot of a Tawny Owl partly concealed in its surroundings, which just pipped Jason Hornblow's beautifully constructed study of a Dipper feeding a recently fledged juvenile. There was equally little argument about Keith Noble's lovely, cheeky Woodpigeon in the humorous section – and great to see common birds reflected also by our Junior Section winner, Brooke Paterson's' attractive and delightfully titled picture of a young Mute Swan cygnet.

The gallery below, and distributed through this edtion, shows all the winners and highly commended entries, with some of the judges' comments. There will be another photo competition later in 2021, with slight amendments to categories and eligibility.

The winners and runners-up
WOS President, Iolo Williams, selected Stephen Culley's composition of a Tawny Owl as the overall winner. Regrettably, the photo was taken at only 72dpi (see below).

A close runner-up was Jason Hornblow's intimate picture of a Dipper feeding its newly fledged young. The judges commented: Great lighting and an intimate shot capturing a lovely piece of interaction of this emblematic resident of Welsh rivers. This photo is on the back cover.

Highly commended
Kingfishers: Karen Burns (see p.30)
Little Egret: Don Cardy (see p.43)
Hawfinch: Bob Garrett (see p. 64)
Grey Heron: Tanya Liepins (see p.79)
Gannet: Steve Stansfield (see p.87)
Merlin: Tony Pope (see p.99)

Snipe reflection: Michael Thackeray

Fisherman at work (Razorbill): Jonathan Bull

The remaining photographs have been taken, mainly, at 72 dpi, with one at 96 dpi, which is a density that is not enough for publication. They are shown as small images, but may still appear pixellated.

Photo competition - overall winner
Tawny Owl: Stephen Culley

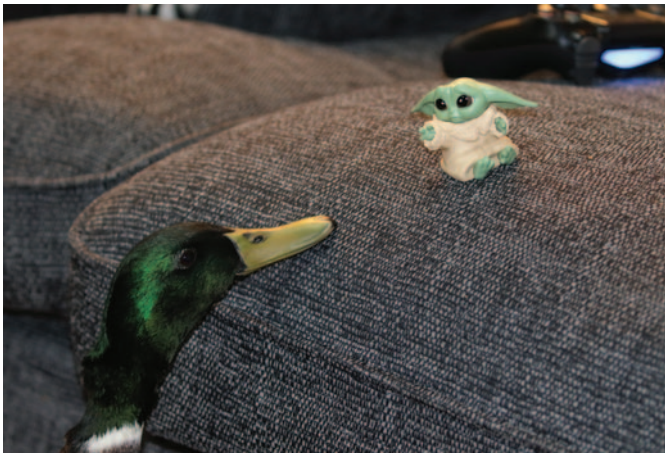
This is the overall winner. The judges commented: *Often difficult to spot by day, this lovely image is superbly framed through the foliage, giving an aesthetically pleasing 'bokeh' effect which perfectly conveys the secretive and hidden nature of the species.*

In the Junior section, the clear winner was 11-year old Brooke Paterson's study of a Mute Swan cygnet. The judges commented that *far from being an ugly duckling, this showed how adorable cygnets are – a well captured piece of behaviour.*

Photo competition - Junior section winner
Gotta whole lot of living to do! (Mute Swan): Brooke Paterson

Photo competition - Humourous section winner
You looking at me...: Keith Noble

There was also a clear choice of winner in the Humorous category: Keith Noble's close up shot of a querulous Woodpigeon prompted the judges to comment that *it was a great capture of the pigeon's expression – an eye-catching portrait framed brilliantly to capture a goofy head-on pose.*



Highly commended from the humourous category

Mallard and baby Yoda by Stephen Culley

Stonechat by Hugh Gregory.

Robin rutting season in full swing by David Parry

Hands up who's hungry! By Rhiannon Sims

From the Junior section:

It's a bird's life! By Brooke Paterson

We really appreciate all the entries – they made judging a delightful and difficult process!

Technical footnote.
Most photos at 72 dpi have been taken using mobile phones. For users of some Samsung phones there is a 'Pro' option which takes photos in Raw that can then be converted to 300 dpi jpg files. For iPhones, there is an app called 'DPI' which allows the user to choose the dpi in which to save the image. Other phones may have similar options.